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ABSTRACT

This handbook has been designed as a teaching resource to be used in the development of student attitudes and competencies, reflecting an awareness of the environment, and a motivation to work toward solutions to its problems. Listed activities are to be adapted to the abilities and interests of students, school locale, and teaching situation. Suggested exercises consist of air, noise pollution, soil, rocks, minerals, ecosystems, trees, plants, marine and freshwater life, animals, population, energy, pesticides, land use, watershed management, private enterprise, student needs and perceptions, and solid waste. Each of the activities or encounters has objectives stated in behavioral terms. The rationale for each undertaking is identified, with needed materials and appropriate terminology. The environmental topics are divided into activities which call for some particular action on the part of students (i.e., observation, collection, identification, comparison, discussion, etc.). Appraisal activities are suggested for teachers to determine the extent of learning which has occurred. The encounters have been made as flexible as possible to give them the greatest utility. They are designed to be implemented in one or more of the curricular areas, and suggestions for integration are provided. Printed and audiovisual materials are also listed. (BP)

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ENVIRONMENTAL ENCOUNTERS

SE 019 632

A HANDBOOK OF ENVIRONMENTAL ENCOUNTERS

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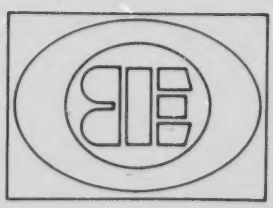

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INTRODUCTION

HOW TO USE THE HANDBOOK

Like other nations, the United States has reached a crisis in environmental management and there is an urgent need for both adults and students to understand the nature of this crisis. There is an equally critical need to reassess our economic and social values and to improve our present environmental management efforts.

The issue is clear. Man is a threatened species. No longer can he pack his belongings and escape to primitive unsettled areas to begin anew. He must accept himself as part of an ecosystem and learn to manage his environment in a manner that will enable him to survive and provide opportunities for future generations.

The role of environmental education is to help students develop an awareness about the environment that will motivate them to work toward solutions to the most urgent problems. Only in this way can we be assured of maintaining a society in which every individual interacts with his environment in a way that will advance human welfare.

This handbook is a resource to those interested in the development of attitudes and competencies useful to man's quest for a quality environment. It should be regarded primarily as a guide. Activities suggested in it should be used or adapted according to the abilities and interests of the students, the locale of the school, and the particular instructional situation.

THE ENCOUNTERS

The encounters, using authentic or simulated situations which are often interdisciplinary in nature, are designed to assist teachers in providing instruction in environmental education. Selected activities may be an integral or supplementary part of a social studies, language arts, fine arts, or mathematics program. Many activities suggest the outdoors as a "classroom" which will stimulate students to become better acquainted with the natural world and the problems man faces in adapting industrial and urban society to its ecosystems.

OBJECTIVES

Every encounter has identified objectives stated in behavioral terms, and their attainment is the primary purpose of the program. Every effort should be made to assess the degree to which students can perform the specified tasks. Appraisal activities are suggested to help teachers to determine how much learning has taken place.

There is another set of objectives which have not been identified. These are the attitudes and values that motivate an individual to behave in the interest of the general welfare. It is reasonable to expect that such responsible attitudes will grow as the student's level of awareness is raised. While behaviors indicating such attitudes will be difficult to measure accurately, they will nonetheless be apparent to the perceptive teacher.

UNIQUENESS OF ENCOUNTERS

Wherever possible, the emphasis of the encounters is student involvement with real situations. It is recognized that this kind of instruction often does not move as rapidly as does instruction which utilizes packaged information. However, the authors believe such real encounters, as proposed herein, afford the student a deeper, personally more meaningful learning process.

A second frequent emphasis of the encounters is open-endedness. Data and other information are collected by the student with the expectation that he will assume responsibility for decision making. This procedure, expecting students to make value judgments, is consistent with the belief that students should develop learning skills and make intelligent decisions based on validated information. The quality or nature of the information may not be sufficient to make final decisions. In that case, instruction should emphasize the tentativeness of such decisions.

CURRICULUM RELATIONSHIPS

Environmental education should not be a separate curricular area. Understanding the relationships between individuals and natural and man-made environments is part of everyday living and as such could be included in all curricular areas. This integration is

accomplished in two ways. First, every encounter is designed to fit one or more of the established curricular areas, such as social studies, language arts, or science. Second, some suggestions are given for integrating encounters into related areas. It is expected that teachers will use various means of adapting encounters to subject areas which interest them.

The encounters are not arranged by levels of difficulty. However, some of them are more adaptable to the lower than the upper grades. They have been made as flexible as possible in order to give them the greatest utility.

Most of the encounters are accompanied by a list of appropriate terminology. Teachers are urged to introduce these and other terms as they occur during instruction.

FOREWORD

Oregonians have been endowed with an environment unsurpassed in beauty. Yet if we are to continue to enjoy the bounties of our state, we all must practice environmental citizenship. Our natural resources must be preserved; education can help us do it.

Among its adopted instruction-related priorities, the Oregon Board of Education has included *Adding the Fourth "R"–Responsibility*. In part this Fourth "R" urges students to learn and to use constructive ways of living with their environment. Moreover, the Board has identified environmental citizenship as a part of Social Responsibility in the new minimum Graduation Requirements; school districts are now developing *program goals, competencies* (course goals), and *performance indicators* to shape their own community's thinking about what the outcomes of a "survival level" environmental education should be.

This handbook has been compiled as a resource for teachers who are planning learning activities to help our students help themselves. In time these students can thus help their own children. By so building together—by making learning a process, we can perhaps keep alive an Oregon environment with beauty unsurpassed.

Jesse Fasold

Jesse Fasold
Superintendent
Public Instruction

ACKNOWLEDGMENTS

Grateful recognition is given to the Environmental Education Advisory Committee members who, for many years, have provided leadership for the development of Environmental Education in Oregon public schools and have devoted untiring efforts to the development of this handbook. Members during the handbook development period included:

William Brewster, Chairman, Assistant Superintendent, Central Point Public Schools, Central Point

Ray Haag, Coordinator, Outdoor Education, Washington County IED, Hillsboro

Mrs. Roberta Ganger, Elementary Teacher, Beaverton

Cliff Hamilton, Conservation Education Biologist, Oregon State Game Commission, Portland

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Mrs. Carol McIntyre, Housewife, Eugene

Leroy Moore, Principal, King Elementary School, Portland

Ronald Nutting, Public Affairs Officer, Georgia-Pacific Corporation, Portland

Dr. Donald Stotler, Director, Environmental Center, Portland State University, Portland

Miss Sally Purbrick, High School Student, South Salem High School, Salem

Tom Tanner, Oregon State University, Corvallis

During the initial stages of curriculum development, a writing team of environmental specialists and teachers devoted generously of their talents to get the project started. They included Donald Emberlin, Verna Keller, Mary Kohl, Nancy Otto, Jack Whitney, Lucia Greco, Kaye Darby, Grace Jenkins, Paul Clair, Steve Kronenberg, and Charles Scott.

Later, some two hundred teachers conducted field testing of the many activities contained in the handbook. Their contribution of time and effort were most valuable and are deeply appreciated.

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State Department of Education staff members who contributed to the development of these instructional materials included George Katagiri, Director of Instructional Technology; Ray Thiess, Specialist, Science Education; Bus Nance, Specialist, Environmental Education; and Howard Brock, Specialist, Conservation and Forest Products.

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AIR

MOVING AIR

Objectives

As a result of this encounter, the student should be able to:

1. Identify the movement of objects such as flags, smoke, trees and clouds which indicate the presence of moving air.
2. Construct a pinwheel and describe how air causes it to turn.
3. Demonstrate by using an electric fan that air carries solid particles.

Rationale

Because air is invisible, it is necessary to detect its presence indirectly. Some of its properties can be studied by observing objects which are affected by moving air.

Vocabulary

air wind direction air pollution

Materials

paper streamers
small paper plates
plastic containers
incense
compass
spray deodorizer
handkerchief
clean jar
nails
dowel

Activity 1

OBSERVING MOVING AIR

On a windy day hand out paper streamers. Tell students that they are going for a walk around the schoolyard. Stop in front of the flag and ask students to observe and discuss its movement. Ask if streamers are blowing in the same way as the flag.

Ask students to look about to see if anything else is being moved by the wind—such as leaves, tree branches, clouds, smoke from chimneys.

Activity 2

IDENTIFYING WIND DIRECTION

Construct paper pinwheels and have students take them outside. Try to locate a spot on the school ground that receives the most wind. Face in different directions to identify the direction the wind is blowing. Name it by sighting a familiar landmark. Using a compass, identify direction from which the wind is coming and repeat periodically. Record the data on a chart. Help students draw conclusions from observations of wind direction. Below are the steps for making a pinwheel.

1. Cut an 8-inch square of heavy paper.
2. Draw 1-inch circle in center of paper and cut from corners to circle.
3. Bend corners 1, 2, 3, 4, over to center and insert straight pin through all ends.
4. Pin to eraser of pencil.

Activity 3

SCENTS IN THE AIR

Bring incense and scented spray deodorizer to class. Without discussion, burn some incense. Let the students make observations about it. Is the smell pleasant or unpleasant? Do they see smoke in the air? Who was the first to smell it? Then spray some of the deodorizer around the room. Again invite observations. Instruct the students to list all the smells they encounter on the way home, at home, and on the way to school the next day.

On the following day, list on the board all student observations based on the sense of smell. Classify them in several ways (pleasant, unpleasant, natural, man-made). It is not necessary for all students to agree. Encourage them to defend their opinions.

Activity 4

DETECTING AIR POLLUTION

Fasten a clean handkerchief to an outside wind mill. See how dirty the handkerchief gets in one day's time—one week's time. Discuss sources of air pollution. Observe and record signs of air pollution such as dirt on cars, buildings, windows.

Activity 5

OBSERVING RAIN

If air is polluted, will rain pick up dirt in the atmosphere? Have students collect rain water in a clean jar and observe for themselves. Would they drink rain water without any treatment? Can it be strained with filter paper?

Appraisal

Have the students construct a wind direction gauge and place it on the school ground in an unprotected spot.

1. Mount a t-bar into a base block.

2. Attach streamers (thin paper or plastic) along horizontal bar.

Have each student identify a way in which his family contributes to air pollution (car exhaust, burning trash) and make a poster or diorama of a constructive solution to this problem.

Language Arts

CURRICULUM RELATIONSHIPS

Write creative sentences and stories about the *feel* of the wind. Record data on charts compiled from activities. List observations using sense of smell.

Fine and Graphic Arts

Construct pinwheels. Sketch trees in the wind. Make a poster or diorama of the solution to one source of air pollution.

Music

SONGS ABOUT AIR AND WIND

Watters, Lorrain E. *Singing and Rhyming.* Boston: Ginn Book Company, 1965-67.

1. Summer Breeze
2. The Night Winds Lullaby
3. Wind in the Trees

Watters, Lorrain E. *The First Grade Book.* Boston: Ginn Book Company, 1965-67.

1. Little Red Leaves

Berg, Richard C. *Music for Young Americans.* New York: ABC Series Book 3, 1970.

1. My Kite
2. Miss Breeze
3. Sailing
4. The Wind Song

Berg, Richard C. *Music for Young Americans.* New York: ABC Series Book 2, 1970.

4

1. Sailboats

SOILED AIR

Objective

As a result of this encounter the student should be able to distinguish the difference between fresh air and polluted air.

Rationale

Clean air is essential to plants and animals. Students should be aware that air pollution is one of man's most urgent problems.

Vocabulary

fumes fresh air polluted air pollution

Materials

wide-mouth glass jar paper bags cardboard tubes sandwich bags (plastic or paper)

Activity 1

EXHAUST POLLUTION

Obtain a motorbike or several small gasoline model airplane engines. Make sure moving parts are disengaged or out of gear, then run for a minute in a fairly closed room. Observe the fumes and feel the discomfort. Discuss how gasoline engines affect the air we breathe and identify some problems caused by our automobile-conscious society. Have students develop alternative solutions to the problems.

Activity 2

EFFECTS OF OVERCROWDING

Crowd children into a small closed room for a few minutes. Encourage them to make observations using their five senses. Then go outside and make similar observations and comparisons. What is the difference between the air in the room and outside? Does fresh air make you feel good?

Activity 3

BREATHING IN A CONFINED SPACE

Breathe into a paper bag (or a breathing bag constructed of a cardboard tube inserted into a paper sandwich bag) for not more than one minute. Do not use a plastic bag! Caution the students to stop the experiment if breathing becomes difficult. Discuss the change in the air. What is it in our environment that keeps air fresh? Emphasize the dangers of plastic bags and old refrigerators.

Language Arts

CURRICULUM RELATIONSHIPS

Write creative sentences about the "feel" of a closed room and fresh air.

Fine and Graphic Arts

Keep a picture record of a plant deprived of air. Draw a chart showing air cycles. Move a green plant or woody shrub from wooded area to a parking lot near the school and watch the results.

Social Studies

Discuss the implications of people living in close crowded quarters. How does this affect their behavior? Discuss the effects of smog on urban dwellers.

Music

SONGS ABOUT AIR AND WIND

Watters, Lorrain E. *Singing and Rhyming.* Song Book. Boston: Ginn Book Company, 1965-1967.

1. Summer Breeze
2. The Night Winds Lullaby
3. Wind in the Trees

Berg, Richard C. *Music for Young Americans.* Song Book. Book 2. New York, 1970.

1. Sailboats

Berg, Richard C. *Music for Young Americans.* Song Book. Book 2. New York, 1970.

1. My Kite
2. Miss Breeze
3. Sailing
4. The Wind Song

Watters, Lorrain E. *The First Grade Book.* Song Book. Boston: Ginn Book Company, 1965-1967.

1. Little Red Leaves

Appraisal

Have students list three places they visit daily where they think air is polluted and three where they think air is clean. Discuss ways to prevent or reduce polluted air.

AIRSHED INVENTORY

Objectives

As a result of this encounter, the student should be able to:

1. Characterize the essential features of an airshed.
2. Describe components of an airshed which may be harmful to man.
3. Identify components of an airshed which result in the deterioration of other natural or man-modified resources.
4. Examine alternative choices to solve air quality problems.

Rationale

Air pollution has become an unwanted by-product of our standard of living. Population growth combined with industrial advances are bringing increased concentrations of hazardous pollutants into the atmosphere. Students need to become aware of the known air pollutants and get involved in decision-making activities to prevent deterioration of environmental quality or to improve it.

Vocabulary

airshed
statistical significance
incinerate
cumulative
sulfur dioxide
inversion
cracking test
sampling
monitor
ozone
emphysema
nitrous oxide
pollution cope

Materials

area maps
clip board
pinto bean seedlings
strips anti-oxidant
bunsen burner and tripod
spinach
ponderosa pine seedling
paper
cloth
weight scale

plastic	cylinders
food wrappers	plastic bags
foil label	weather map

Rubber strips 5/16 inches by 2 inches, cut from 9 inches by 9 inches by 1 1/6 inch sheets of Ozone Sensitive test pads, Goodyear spec. No. 563-27303. This special rubber should be ordered from Goodyear Tire and Rubber Company, 1356 Tennessee Avenue, Cincinnati, Ohio, or from the nearest Goodyear district sales office.

Three dram bottles for unexposed rubber strip (available from a local drug store).

Activity 1 **STUDYING ACTIVITIES OF AN AIR QUALITY REGULATION AGENCY**

Contact or visit a local air pollution authority or city health department. Discuss with representatives the activities conducted to safeguard the community's air quality.

Try to identify specific situations and problems. Send class representatives to public meetings and hearings related to air quality control. Discuss what decisions and responsible actions students and student committees might take to contribute to alleviation of air quality problems. Identify the means by which air pollution control is financed.

Activity 2 **INDUSTRIAL IMPACT ON AIR QUALITY**

Students should become familiar with several kinds of problems posed by industrial discharge. Locate major industries which contribute to air quality problems in the region.

Visit industrial plants as a group or request plant representative to speak to the class about air quality. It may be helpful if students prepare questions in advance based on their own knowledge of local industries.

Activity 3 **AUTOMOBILE POLLUTION SURVEY**

Select an area of heavy traffic (call police department for information). Interview residents and pedestrians around the area, after preparing a list of questions in advance related to specific aspects of pollution; e.g., eye irritation, damage to plants, breathing problems. As a result of the survey students may compile data and present it to local air quality authorities, to newspaper reporters, or to the public in the form of a letter to the editor.

Activity 4 **AIR POLLUTION METHODOLOGY**

Visit local air pollution control laboratories or sampling sites to learn methods of monitoring air pollutants. If this isn't practical, have air quality personnel bring a portable unit to the school to demonstrate procedures.

Activity 5 **OUTDOOR BURNING OR INCINERATION**

Incinerate samples of common combustibles under a laboratory hood one at a time, noting characteristics of burning. Use small amounts of slow burning substances such as wood, paper, or a candle. Do not use volatile materials such as gasoline, lighter fluid, or alcohol! Note if smoke is produced. Can it be burned? After weighing a sample, measure the time it takes to burn. Note residue remaining. Samples may be weighed after burning. Discuss large-scale incineration of various materials. Learn how your community disposes of combustibles. If possible, visit disposal sites. If incineration is used, check for the presence of air monitoring devices. Select a residential area to do a survey of incineration practices and attitudes toward air pollution. Compare results with previous surveys of automobile and industrial air pollution.

Activity 6 **SMOG OZONE DETECTION**

Ozone, a major component of smog in some areas, has a deteriorating effect which shortens the life of tires and other rubber products and harms the lungs. Perform a rubber cracking test of the presence of ozone. If ozone is present in smog, a cumulative test can be made by hanging a bent loop of rubber (2 inches by 12 inches tied together and weighted down with 300 grams fish weight) outside in a shady spot for one week. Also, the presence of ozone can be demonstrated by inserting a piece of bent rubber in a flask of ozone. Deterioration of rubber will be apparent at the point of tension. Capacity of the rubber to stretch should also be observed.

Activity 7 **EFFECTS OF NOXIOUS GASES ON PLANT GROWTH**

Expose plant seedlings (spinach, pinto bean, and ponderosa pine) in small pots to a partial

atmosphere of ozone (SO_2 + NO) noting the effects on plant growth compared to a group of control plants. This can be done by placing a small jar of gas/air mixture in a plastic bag tied over the plant. Be certain to run a control on plants in a plastic bag containing no ozone and plants exposed to room air.

Activity 8

PUBLIC HEALTH HAZARDS

Contact a local public health department to learn what ailments in your community, such as allergies and respiratory diseases may be caused or aggravated by air pollution. Consider mapping areas of concentration of such ailments and relating the results to the location of industrial plants. Use local public health and state board of health data for this study.

Activity 9

WEATHER INFLUENCES ON AIRSHEDS

Contact the weather bureau to learn details of air movement in your community. See "Air Pollution Experiments for Junior and Senior High School Classes" (bibliography below). Request a local meteorologist to speak to your class on the subject.

When all the information has been collected and recorded, map the airshed locations and pollution core, if one exists. Establish the major sources of smog and consider possible ways to correct air quality problems.

Appraisal

From an airshed map, have students describe some of the major influences affecting air quality in the region. Have students list common air pollutants in the region and their effects on man. Identify at least four effects of pollution on plant life. Given a set of air quality conditions, the students should be able to predict the eventual effects on the community and be able to suggest ways to improve the situation.

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Take Three Giant Steps to Clean Air. Public Health Service Publication No. 1551, U. S. Government Printing Office, Washington, D. C. 20402.

CONSTRUCTING AN AIR POLLUTION SCALE

Objectives

As a result of this encounter, the student should be able to:

1. Demonstrate a procedure to collect measurable amounts of particles from the air.
2. Identify some of the causes of smog and propose possible solutions for their elimination.
3. Demonstrate a procedure for measuring the distance of landmarks from the school on a street map.

Rationale

Smog is a growing problem in many areas in Oregon. Too many people accept the deterioration of the environment as the price of progress without being aware that methods for control or elimination of pollution are available.

The aim of this activity is to make the student aware of the smog problem and to identify a course of action to reduce or eliminate it.

Vocabulary

smog particles

Materials

street map
one or more small buckets
string or narrow white tape
yardstick
Beaufort Scale of Wind Force
paper for wall charts

Activity 1

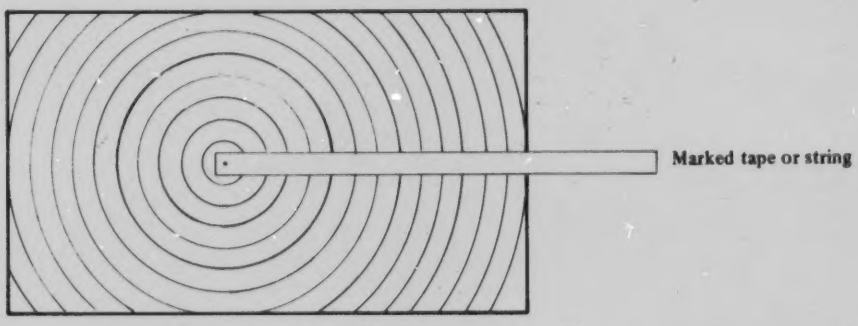
PREPARATION OF A SMOG INDEX

Identification of Landmarks

Locate landmarks easily seen from your school. Begin close to school and go as far as you can see. Locate and mark these landmarks on a map.

Making the Scale

Use the scale of miles or feet found on most street maps. Measure off distances in equally spaced circles from your school. Use the tape or string which has been marked to measure distances between circles.



BEAUFORT SCALE OF WIND FORCE

Beaufort Number	Description of Wind	Limits of Velocity (in m.p.h.) at 30 ft. above ground	Specifications for Use on Land
0	Calm	less than 1	Smoke rises vertically.
1	Light Air	1-3	Direction shown by smoke, but not by wind vanes.
2	Light Breeze	4-7	Wind felt on face; leaves rustle; ordinary vane moved by wind.
3	Gentle Breeze	8-12	Leaves and small twigs in constant motion: wind extends light flag.
4	Moderate Breeze	13-18	Raises dust and loose paper; small branches are moved.
5	Fresh Breeze	19-24	Small trees in leaf begin to sway.
6	Strong Breeze	25-31	Large branches in motion; umbrellas used with difficulty.
7	Moderate Gale	32-38	Whole trees in motion; inconvenience to walk against wind.
8	Fresh Gale	39-46	Breaks twigs off trees; generally makes walking difficult.
9	Strong Gale	47-54	Some structural damage.
10	Whole Gale	55-63	Trees uprooted; considerable structural damage.
11	Storm	64-75	Widespread damage.
12	Hurricane	Above 75	Severe widespread damage usually accompanied by loss of life.

9

Depending on its severity, smog limits visibility. Landmarks are seen with varying degrees of clearness. Have the class make its own smog index. Visibility of details on the landmarks may be used for this purpose. Photographs taken on particular days may be compared with the smog index determined by the weather bureau for those days.

Keep a daily log of smog density evidenced by visibility.

Activity 2

OTHER OBSERVATIONS AND DATA COLLECTING

With each day's observations of smog density, observe the following:

1. Any easily identified smell. Try to locate its source.

2. Wind direction. From which direction does the greatest source of pollution seem to come?
3. Wind speed. (Use Beaufort Scale of Wind Force.) At which speed is the smell greatest? Least?
4. The amount of fallout. (Use buckets made from plastic bleach jugs. Be sure to put an inch of water in each bucket so that the particles are not blown out.) Place the buckets at various places around the school grounds. Filter the water and examine the collected particles.
5. Which days eyes and nose are affected.
6. Anyone who has difficulty breathing on days when smog is heavy? Describe his symptoms.
7. Days of the year when smog conditions are worst and best?
8. The season which has the worst smog conditions?

Activity 3

DISCUSSION QUESTIONS

For information phone or write governmental agencies and use reference works.

1. What is the composition of smog?
2. What causes smog to stay on the ground?
3. What can be done to reduce smog?
4. Does your community have an agency which monitors air pollution?
5. What instruments does it use?
6. Does your community have air pollution standards?
7. Who sets these standards?
8. How are they enforced?

Appraisal

1. Show evidence that your community has or does not have a serious smog condition.
2. List the sources of smog in your community.

CURRICULUM RELATIONSHIPS

Mathematics

Construct a graph showing smog density in relation to wind speed.

BIBLIOGRAPHY

Public Documents

U.S. Public Health Service. *Take Three Giant Steps to Clean Air.* Publication 1551. U.S. Government Printing Office.

Audiovisual Resources

Beware of Ill Winds. Filmstrip and Manual. Sophisticate Film Corp., P.O. Box 70, Meacham Branch, Elmont, New York 11003.

Pamphlets

Hunter, Donald C., et al. *Air Pollution Experiments for Junior and Senior High School Science Classes.* Air Pollution Control Association, 440 5th Avenue, Pittsburgh, Pennsylvania 15213, 1969.

Air Pollution Control Primer. National Tuberculosis and Respiratory Disease Association, 1969. (Contact nearby chapter.)

Air Pollution, the Facts. National Tuberculosis and Respiratory Disease Association, May 1967. (Contact nearby chapter.)

BURNING-AN AIR POLLUTION PROBLEM

Objectives

As a result of this encounter the student should be able to:

1. Formulate tentative conclusions on what constitutes acceptable and unacceptable forms of burning among such practices as trash burning, slash burning, field burning, and industrial burning.
2. Identify the individuals, groups, organizations, and agencies involved in problems related to burning practices.
3. Identify and describe the different points of view related to burning problems.

Rationale

For years we have assumed that waste disposal by burning is a matter of individual concern. However, we have reached the point where air pollution caused by burning of wastes must be severely restricted by government authorities. There is much controversy involved in regulations which are proposed or now in force. By examining the controversy on the local level from all sides, the student can gain experience in studying such problems in a rational, objective manner.

Vocabulary

field burning industrial burning trash burning

Materials

Air pollution measuring kits. Free manual *Millipore Experiments in Microbiology*, from Millipore Corp., Bedford, Mass. 01730. Additional equipment necessary.

Activity 1

BACKGROUND DISCUSSION

Discuss with students the question of whether or not we really need air pollution controls. Assuming the answer to be affirmative, discuss the validity of having restrictions on all types of burning, from burning leaves in the fall to daily burning by factories or mills in your locality. In this discussion your role as a teacher should be to help students to identify problems related to current or proposed burning regulations.

Activity 2

BURNING EVALUATION

Enlisting the aid of the science department, have students either as a body or in smaller interest groups develop basic questions related to burning. Questions to be answered might include the following:

1. Is the smoke from all burning material equally harmful to the environment?
2. If not, how can smoke from various burned materials be ranked in order of their effects and potential danger?

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Activity 3

FIELD TRIP

Take a series of field trips, as a class, in small groups, or individually, to locations where there is field, forest, or trash burning. Learn through interviews and observation what the waste problem is and what burning practices are followed.

Activity 4

FIELD TRIP

Visit your local environmental control agencies, particularly those directly involved in and responsible for enforcement of waste burning laws. Through interviews, assess the events which led to the passage of these laws. State and federal environmental agencies can provide useful information.

Activity 5

DEBATE

In class discuss or debate issues involved in the waste burning controversy. Consider whether the public good and public health are more important than private gain; whether it is better or not to have a polluting industry which provides jobs in a community.

Activity 6

SIMULATION

Create a role-playing simulation to involve students, using all the information accumulated from field trips and other sources.

Appraisal

Discuss with students the possible relevance or validity of the attitudes and arguments they have been exposed to in this exercise, keeping in mind what modern science is saying about the harmful effects of waste burning and other forms of air pollution and also keeping in mind vested economic-political interests.

Have students through some form of individual expression (oral statement, position paper, film, video tape) explain how they would resolve the problem if they had the power to do so. Students should indicate how they plan to accommodate the various interest groups.

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CURRICULUM RELATIONSHIPS

Science

Determine different chemical pollutants most commonly emitted by various industries in the community. See Activity 2.

Language Arts

Have students prepare articles for publication in the school paper. They should reflect each individual's position on the burning controversy. (Also see Appraisal.)

BIBLIOGRAPHY

Books

Johnson, Huey D., ed. *No Deposit, No Return.* Reading, Massachusetts: Addison-Wesley Publishing Co., 1969.

Weaver, Elbert C., ed. *Scientific Experiments in Environmental Pollution.* New York: Holt, Rinehart and Winston, Inc., 1968.

Periodicals

Griffin, C. W., Jr. "America's Airborne Garbage." *Saturday Review,* May 22, 1965.

Tufty, Barbara. "Poison Gas of Peace." *Science Newsletter,* October 23, 1965.

Audiovisual Resources

The Division of Continuing Education Film Library, Corvallis, Oregon, has these films:

Air Pollution *Day at the Dump* *Problems of Conservation–Air*

PREDICTING RELATIONSHIPS BETWEEN WIND SPEED, WIND DIRECTION, AND AIR POLLUTION

Objectives

As a result of this encounter, the student should be able to:

1. Measure wind speed by using an anemometer.
2. Identify surface wind direction by using a wind vane.
3. Construct a chart which indicates wind direction and wind speed in relation to the air pollution index over a period of three weeks.

Rationale

Wind is an important factor in man's control of air pollution. This exercise is designed to familiarize the student with wind properties.

Vocabulary

anemometer
pollution index
wind direction
wind vane
wind speed (see Beaufort Scale of Wind Force, page .)
wind

Materials

4 paper cups
3 coat hangers
10 paperclips
1 stick
4 pegs
plastic cement
2 eye droppers
2 nails and stick of wood dowels
masking tape
1 cardboard arrow
1 tin can lid from No. 10 can

Activity 1

CONSTRUCTING A WIND VANE

1. Cut a small arrowhead and larger tail from thin wood, plastic or tin can. If a can is used, tape the edges to prevent accidental cuts.
2. Bend a coat hanger and cut off curled ends.
3. Bend double oval loops at each end. The loops should be in line with each other.
4. Insert the arrowhead and tail into the loops.
5. Find the balancing point along the vane and at that point bend a loop to fit around a medicine dropper or small test tube.
6. If medicine dropper is used, close the smaller open end of the glass tube with an alcohol or gas burner. When cool, insert it in the loop.
7. Insert a long stiff wire into the end of a dowel and place the vane over the wire.

Activity 2

CONSTRUCTING A GROUND COMPASS

Make a ground compass by using a compass as a point of reference. Beginning at the point of reference, put a peg in the ground at a true north position. Turn around, walk two paces, and place a peg in the ground indicating south. Locate east and west in the same manner. Then place the arrowhead of the wind direction finder in the middle of the compass. The wind vane arrow will point in the direction from which the wind is blowing.

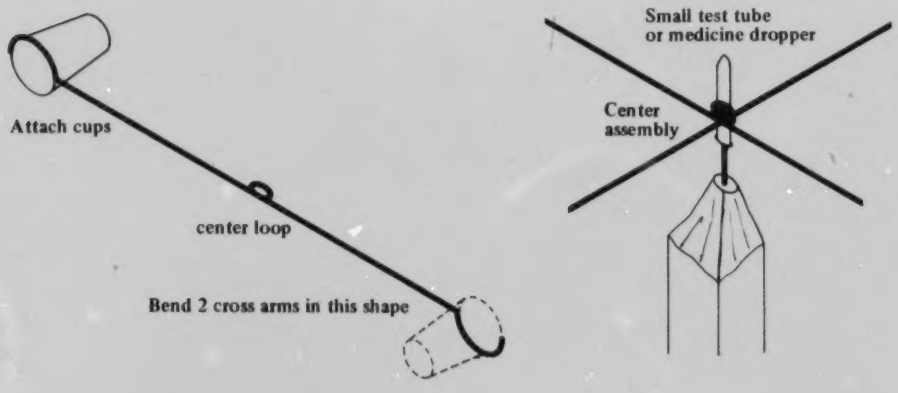
How can the ground compass help to measure wind direction? When will the arrow change direction? Why is it important to know the wind direction? What happens when the wind direction changes? Why is a compass used? What happens when the wind vane is placed in a protected place?

Activity 3

CONSTRUCTING AN ANEMOMETER

1. Straighten out a coat hanger and cut off the bent ends.
2. Bend a loop in the center of the hanger to fit the diameter of an eye dropper or small test tube.
3. Bend the ends of the hanger into a U shape in opposite directions and parallel with the face of the loop. The U should be of a size to fit the inside of a paper cup.
4. Using the paper clips or masking tape, fasten a paper cup over the U at each end of the hanger.
5. Repeat the above steps with another hanger.
6. Color one of the cups with paint or crayon to facilitate counting the number of turns the anemometer makes every 60 seconds.
7. Insert the eye dropper or test tube through the loops in the center of the hangers, using masking tape to fasten the hangers in a + shape.
8. Drive a nail into the end of the stick (or wood dowel); clip off and sharpen the end of the nail, making a spindle.
9. To calibrate the anemometer, take a ride in a car on a quiet road on a calm day. Sit next to the right front door with the window open. Hold the anemometer outside the window at five miles per hour. As the car moves, count the number of turns of the anemometer in 30 seconds and write it down; e.g., "5 miles per hour = 27 turns." Then increase the speed to 10 miles per hour and note the number of turns in 30 seconds; repeat the procedure at 15 and 20 miles per hour.

10. After calibration, mount the anemometer in the school yard where the wind can blow against it.



This anemometer gives only an approximate measurement of wind speed.

Why is it important to know the wind speed? How can this instrument be used to record wind speed? What common measurement is used to determine wind speed? What happens when the anemometer is in an open place compared to a protected location?

14 **Activity 4**

CHARTING DATA

Construct a chart so that the wind direction and wind speed are recorded at the same time each day for a period of three weeks. This chart should be devised so that the air pollution index printed in the daily newspaper is also graphed.

What can be learned from daily records? Why is it important to keep charts? Is there a relationship between wind readings and pollution index?

Appraisal

Using the data collected on the chart, make predictions that show a relationship between wind direction, wind speed and the air pollution index at different times of the year. For example, compare fall to spring.

CURRICULUM RELATIONSHIPS

Social Studies

Compare prevailing wind speed and direction in your community to other parts of the state. Is there a relationship between wind speed and pollution in industrial areas, in farm communities?

Fine and Graphic Arts

See Activities No. 1 and 3.

NOISE AND NOISE POLLUTION

SOUND ABSORPTION AND REFLECTION

Objectives

As a result of this encounter, the student should be able to:

1. Demonstrate ways that a sound can be changed by absorption or reflection.
2. Demonstrate that plants absorb sound.

Rationale

Because sound in our world is increasing at an alarming rate, man has developed many ways to muffle or lessen it with acoustical tile, rubber bumpers, and other devices.

Excessive noise in our environment causes physical and mental problems. Since plants can absorb sound waves, proper landscaping lessens some of the noise that is disturbing to man.

Vocabulary

absorption reflection acoustics

Materials

tuning fork
cardboard tubes from paper rolls (class load)
12 glass jars or tumblers (uniform size)
small wooden blocks
percussion instruments such as:
- triangle
- tone block
- maraca (rattle)
- castinets
- bell

rubber eraser
6 squares of napped cloth, 9 inches by 9 inches (velvet, corduroy, felt or wool)
paper tissues, paper towels, napkins, scraps of cloth, sponges
class load plastic cups

Activity 1

OBSERVING SOUND

Distribute plastic paper cups to students and ask them to voice a continuous tone. At the same time, pointing the cup opening toward themselves, have them move the cup forward and backward slowly and observe the change in sound. They can feel the vibrations as the sound reaches the wall of the cup and hear the echo when the sounds bounce back.

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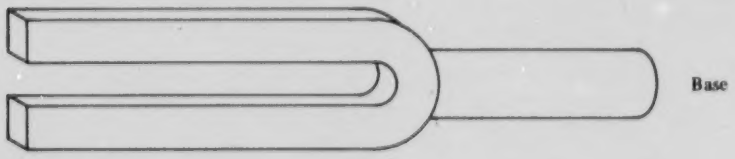
Now have each student make a tone and press the cup tightly over his mouth. Observe that the sound is muffled as it is absorbed into the cup.

Activity 2

ABSORPTION OF SOUND

1. Place the rubber eraser and piece of felt or corduroy on a table. Strike the tip of the tuning fork tines on the eraser and place the base of the fork on the table. Listen to the humming sound. Have a student strike the fork on the eraser and place the base on the table. Repeat and place it on a piece of cloth. Listen to the difference. Have other students repeat the procedure, but each time fold the cloth once to double the thickness. Notice that each time more sound is absorbed until it is finally absorbed completely. Be sure to place the tuning fork on both the table and cloth each time for comparison.



Tuning Fork

2. Divide into groups of five or six and have each group place two glass jars on the table. Stuff one jar with paper towels and leave the other empty. Tap on the side of the two jars with a pencil, one at a time, and listen to the differences in sound. Let each student experience the tapping.
3. Divide the class into groups of five or six. Each student should have a cardboard tube. Provide a supply of paper towels, napkins, paper tissues, scraps of cloth, sponge, number block, and newsprint. Let each student "hoo-oo-oo" through his tube. Then stuff it with whatever material he chooses and "hoo-oo-oo" through it again to see how the sound is muffled.

4. Divide the class into groups of five or six. Give each a percussion instrument and piece of cloth. Have every student strike his instrument. Then have him fold the cloth and place it around or over the instrument and strike it again.

Activity 3

REFLECTION OF SOUND

1. Take the class to the gym, cafetorium, or any other large empty room. Let each student do something he thinks will make an echo. Move to different parts of the room to see where the sound is reflected best.
2. Have a student stand at different places in the classroom and clap a pair of cymbals. He should hold the cymbals so they cannot vibrate by placing his fingers on top of the metal. Discuss the differences in the echo when it comes from different parts of the room.

Activity 4

EFFECT OF SCREENING SOUNDS

Have students on the school ground (with no vegetation between them) listen to a record or other sound that can be regulated by volume. Move to an area where a hedge or some plant is a screen between students and the sound. Have them determine if there is a difference in the sound level. (Note: Sound meters can also be utilized, if available.)

This activity can be repeated in a park or woodland area to show the effect of distance and screenings on sound levels.

Activity 5

EFFECTS OF MATERIALS ON SOUND

Using the tuning fork as described in Activity 2-1, classify materials as (1) those which absorb sound and (2) those which do not. Test such things as wood, cloth, plastic, cardboard, paper, sponge, chalkboard eraser, glass, candle, metal bookends, a book, and other available materials.

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Place an empty cardboard carton, empty wastebasket, large paper bag, and large tin can in front of the room. Let each student choose one and then put it over his head or face and speak into it. See if the sounds are echoed.

Activity 6

CONTROVERSIAL SOUNDS

Suggest to students an essay topic such as, "The Supersonic Transport." This will give them an opportunity to investigate the problems associated with the controversial airplane which Congress refused to subsidize after about $1 billion of federal money was invested in it. Suggest they learn the pros and cons of the SST and why Russia as well as France and England are going ahead with their supersonic planes.

Appraisal

Place all the materials you have used in this exercise on a table and let each student choose two objects to strike together to make a sound which can be reflected. Then he should demonstrate a way to muffle the sound.

BIBLIOGRAPHY

Article

Kryter, K.D. "Sonic Booms from Supersonic Transport." *Science,* January 24, 1969.

NOISE AS A POLLUTANT

Objectives

As a result of this encounter, the student should be able to:

1. Identify and list as many different noises as can be distinguished in a variety of settings.
2. Measure his own work output, both in quantity and accuracy, under varied but controlled, noise conditions.

Rationale

As our population grows, living space becomes more crowded. Trucks, planes, cars, television sets, and radios increase. There is some evidence that noise affects both physical and mental health. This encounter may help students understand the significance of noise and quiet in a classroom situation.

Vocabulary

nonsense syllables pollutant

Materials

note pads pencils sound producers (radio, phonograph, electric motor)

Activity 1

LISTENING

Every student, equipped only with note pad and pencil, should spend 10 minutes or more in several places listening to sound. For example, the student may listen on the school grounds, on a downtown street corner, in the living room at home, inside a factory, in a repair shop, or in a city park. The period should be the same for each location. Students should define noises which are "pleasant," "unpleasant," and "neutral." They should rate sounds accordingly.

Activity 2

EXPERIMENTING WITH NONSENSE SYLLABLES

A room or laboratory should be equipped with one or more sources of "noise." With no noise or distractions, students should be given lists of nonsense syllables and asked to memorize as many as possible in a five-minute period. There should be no outside noise to distract them. The syllables need not be memorized in the order shown on the lists. At the end of five minutes, they should be given two minutes to write as many as they are able to recall. The entire list should then be written on the chalk board or projected on a screen so students can count the number of correct responses. They should label their lists "no noise" and put their scores on the papers, which should be saved for later use. Note: A list of nonsense syllables can be developed easily, or may be found in most textbooks in experimental psychology. Fifty syllables should be adequate. (Examples: nur, alb, vit, taz, kib, ope, etc.)

Activity 3

EXPERIMENTING WITH NOISE

Introduce distracting noise (for example, a radio talk show) to the room. Begin with a relatively low volume. Give students new lists of 50 nonsense syllables and follow procedure outlined in Activity 2. Again, have students save scored papers. Repeat with the radio at progressively higher levels of intensity, and other varying noise sources.

Activity 4

RECORD DATA IN CHART FORM

Have students put their scores in chart form such as:

	Radio	Phonograph	Motor	No. Correct Syllables Recalled
Low Volume				
Medium Volume				
Higher Volume				
Very High Volume				

The student should enter in each block the number of correct responses made under the circumstance.

Appraisal

Ask students to make a composite "class chart" and identify trends. Can they offer explanations for the individual results? Class results?

Encourage student discussion of environmental noise problems in our society and list them.

CURRICULUM RELATIONSHIPS

Science and Social Studies

Study effects of noise on human behavior. See bibliography.

BIBLIOGRAPHY

Books

Ehrlich, Paul R. and A. H. Ehrlich. *Population, Resources, and Environment.* San Francisco: W. H. Freeman and Company, 1970.

Shurcliff, W. A. *SST and Sonic Boom Handbook.* New York: Ballantine Books Inc., 1970.

SOIL AND LAND USE

SOIL

Objectives

As a result of this encounter, the student should be able to:

1. Identify three soil colors and textures.
2. Make a chart showing the cycle of growing and decaying plants and their relationship to soil.
3. Demonstrate through construction of a terrarium the interdependence of plants, animals, soil, and water.

Rationale

A study of soils will help the student understand land use and soil conservation.

Vocabulary

soil particles decay cycle charcoal terrarium humus

Materials

Aquarium tank or wide-mouthed gallon jar.

Activity 1

COMPARISON OF SOIL COLORS

Take students on a walk around the school yard or a nearby field or woodland and collect soil samples. Look for soil colors. If variations cannot be found, have students bring soil samples to class to compare with those taken on the walk. Discuss factors that influence color of soil.

Activity 2

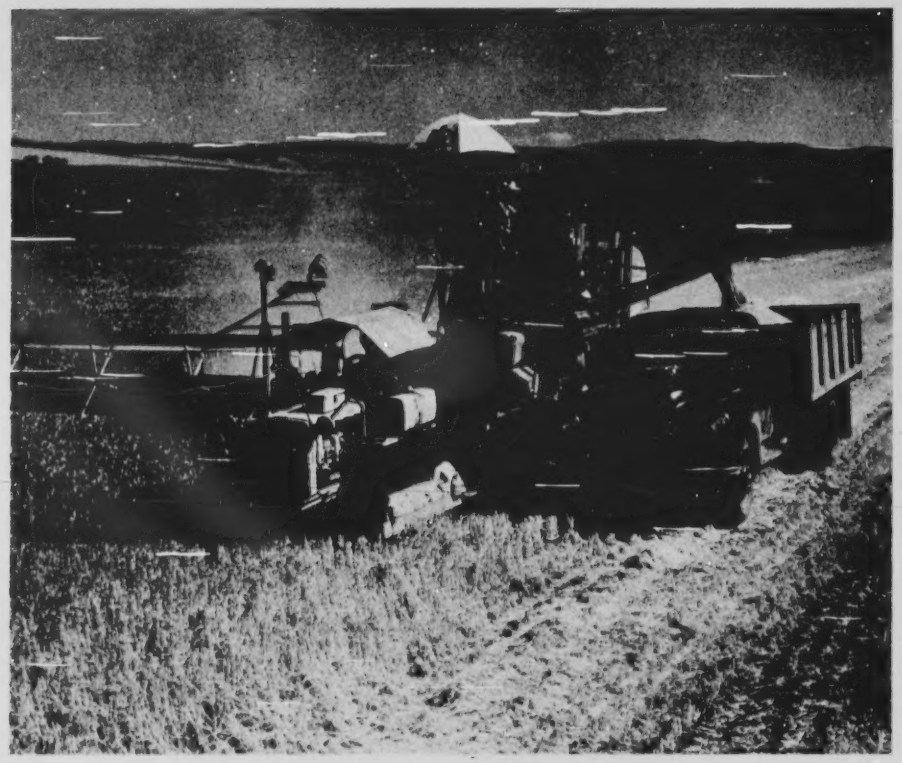
COMPARISON OF SOIL TEXTURE

Take the class outside to the school soil bank—or a place where soil is observable. Have each student take a handful of soil and work it in his hand. Discuss the feel or texture. (Encourage use of good descriptive words.) Then moisten samples. Does this change the feel? Does it stick together? Is it like sand? Is it like clay? Discuss the particles. What are they like? Would the soil soak up water or let it run through? Would it be good for a garden?

Activity 3

OBSERVATION OF PLANT GROWTH AND DECAY

On a walk around the school ground name or "touch and describe" all the growing plants. Sit down and talk about what conditions plants need in order to grow. Elicit the understanding that plants get nutrients and water from the soil. Walk to an area where there



is decaying material such as a rotten log or rotting leaves. Ask what is happening here? Are these things alive? Where do they go as they decay? Do they change the soil?

On a cardboard, have the students draw a picture showing the cycle of plant growth and decay.

Activity 4

CONSTRUCTING A TERRARIUM

The teacher suggests, "Let's build a small world of our own. What do you think we'll need to make this world?" (Students suggest soil, plants, animals, water, air.)

Equip the class with trowels, buckets, plastic bags and take them out to collect materials for their terrarium. They should find gravel or sand, charcoal, wood soil containing humus, small plants and tree seedlings, mosses, ferns, lichens, and an interesting rock or two.

Assemble the terrarium, having the students decide what should be put in first (one or two inches of gravel or sand–to store the excess water). What should come next? (Charcoal – to keep the soil from getting sour.) Then add the soil three or four inches deep. Plant the small plants, covering the remaining soil with moss.

Sink a small container or saucer into the soil. Put water in the dish and also sprinkle the plants. Place rocks in position and cover the container with glass cover or plastic secured with a large rubber band.

Have students find animals after the terrarium has been assembled. Suggest they look for such creatures as snails, grasshoppers, frogs, lizards, beetles, and caterpillars.

Observe from day to day:

1. The growth of the plants.
2. "Rain" in the terrarium.
3. Animals eating.

Appraisal

Have the students bring from home containers (glass candy dishes or wide-mouthed peanut butter jars) and make their own terrarium. Let them find as many of their materials as possible. Review procedures for assembling the terrarium, which may be the desert, semiarid, or "rainy" type. Use large jars, plastic bags, or whatever is available. Whether the terrarium flourishes or not, it should provide a good learning situation.

CURRICULUM RELATIONSHIPS

Language Arts

Write creative sentences or stories about the "feel" of soil. Record daily observations of the terrarium.

Fine or Graphic Arts

Mix paints to duplicate colors of soil samples, and make a chart showing origin of different colored soil. Sketch pictures of plant-soil cycles.

Music

SONGS ON SOIL

American Singer, Book I. New York: American Book Company

1. Working
2. Planting My Garden
3. Our Garden
4. Planting Seeds
5. Little Seeds
6. Pussy Willow

STUDY OF A SOIL PROFILE

Objectives

As a result of this encounter, the student should be able to:

1. Identify the function of soil.
2. Observe and record the color, texture, structure and depth of a soil sample.
3. Determine and record the pH of each soil horizon.
4. Measure and record the temperature of each soil horizon.
5. Interpret data collected from observation of the three soil horizons and predict at least two characteristics which can be found.

Rationale

This activity is designed to acquaint the student with the characteristics of soil and the plant life each type will support.

Vocabulary

soil horizon
humus
soil
pH
sand
silt
alkalinity
clay
platey
blocky
granular
columns
micromonolith
acidity

Materials

ruler, yardstick or tape measure
stapler
cardboard, 3 x 7 inches
thermometer
jelly cups or plastic food wrap
pH soil kit (obtained from the U.S. Forest Service, LaMotte pH Soil Test Kit, $1.75)
interpretation charts

Activity 1

STUDYING A SOIL PROFILE

Locate or dig a soil pit on or near the school grounds. Identify the three soil horizons or layers. Usually a pit may be prepared by digging a hole approximately 2 1/2 feet deep (the depth is determined by each soil horizon). Enlarge the pit in width and length to accommodate the investigating team.

After a soil pit has been prepared, have each student take a handful of soil and describe it in as many ways as he can, involving as many senses as possible. Discuss with students their soil descriptions and formulate a working definition of soil, either in written or oral form.

Using the soil pit as the study area, ask each student to look at it for three or four minutes and then write down all the things he observes. Share these observations with the group and compare them. The following questions are designed to aid in the analysis:

What color differences were seen?

How did the soil look at the three levels?

Why isn't the soil the same at each level?

How far down do plant roots go?

What happens to the humus level?

Activity 2

RECORDING DATA

At the soil pit divide the students into small work teams and have each record the depth of every horizon. This is done by measuring the distance of each layer with a tape measure, ruler or yardstick. Have each team determine and record the color of every layer. Have students feel the soil to determine the texture, and record it according to classification – sand, silt, or clay. As the soil breaks apart, ask if it is *platey, blocky, granular or columnar.* Platey soil breaks into flat sections like slate; blocky soil breaks into chunks; granular soil comes apart in small particles like gravel; columnar soil breaks into vertical sections.

Have each student collect a specimen from every soil horizon. Fill a jelly cup with soil, stapling the lid (a piece of cardboard 3 inches by 7 inches) on the cup; place it upside down, marking the horizons A, B and C. Soil samples may be wrapped in plastic wrap, labeled and glued onto cardboard if jelly cups are not available. This display is called a micromonolith. What does the soil color indicate? Why is it important to know the texture of the soil? What does the depth of each horizon tell the observer?

Activity 3

RECORDING DATA

1. Using a metal-tipped thermometer, have each team record the air temperature and then predict if the soil temperature will be cooler or warmer, and why. Have each group note the temperature of the three horizons, and record each on the chart. Compare the results verbally and discuss why temperatures vary in the soil. Why is it important to know the soil temperature?

2. With a soil pH kit, have each team test the soil for acidity or alkalinity and compare the results for each horizon. Follow the directions given in the kit and use the color comparison chart to check if the soil tends to be acid or alkaline. Record the information on the chart. What can be done to a soil that is too acid or too alkaline?

   What plants like to live in acid or alkaline soil? How can you tell?

Appraisal

Using the charts in this encounter, have each student interpret the data he gathered from the study of soil horizons. The interpretation should be written and then discussed and compared with others in the class. Such questions as the following might be asked:

How do texture and structure affect the movement of water and air through the soil?

Do you think the soil is fertile? Why?

CURRICULUM RELATIONSHIPS

Social Studies

Investigate the problem of soil conservation in the state, or in your county. Information may be obtained from the county extension agent. What are the effects of soil erosion? How is soil erosion created? What does the federal government offer in the way of aid to farmers to combat soil erosion? Contact the State Department of Agriculture if you need more information.

Science

Find out what means scientists have developed to balance soils too acid or too alkaline. Develop an experiment to demonstrate the effects of soil pH on plant life.

Language Arts

Write a few paragraphs about the importance of soil to human and animal life. Express the meaning of soil to you in a poem. Personification might prove interesting.

Fine and Graphic Arts

Draw a diagram of the soil, using crayon. Match texture and structure, if possible.

BIBLIOGRAPHY

Books

Milliken, Margaret, Austin Hamer and Ernest McDonald. *Field Study Manual for Outdoor Learning.* Minneapolis: Burgess Publishing Co., 1969.

(1) Information on Soil Profile
Sketch your soil profile, label the horizons and record the data.

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PROFILE SKETCH

DATA

Contents of Duff: _____

_____, Depth _____" to _____"

A. Horizon

Topsoil: Depth _____" to _____" Color _____

Texture: Sand _____, Silt _____, Clay _____

Structure: Columns _____, Blocky _____,

Platey _____, Granules _____

pH _____, Temp. _____°F, Plant Roots _____

B. Horizon

Subsoil: Depth _____" to _____", Color _____

Texture: Sand _____, Silt _____, Clay _____

Structure: Columns _____, Blocky _____,

Platey _____, Granules _____

pH _____, Temp. _____°F, Plant Roots _____

C. Horizon

Parent: Depth _____" to _____", Color _____

Material

Texture: Sand _____, Silt _____, Clay _____

Structure: Columns _____, Blocky _____,

Platey _____, Granules _____

pH _____, Temp. _____°F, Plant Roots _____

Type of rock in the bedrock: _____

(2) Analyzing Soil Data

The following information will help you interpret the data collected from the soil profile and enable you to answer the questions in Section 2.

A. Effects of soil depth on plant growth and water storage.

Deep (42" and over)–excellent plant growth and water storage.

Moderately deep (20"–42")–good plant growth and water storage.

Shallow (20" and under)–poor plant growth and water storage.

B. Effects of color on soil (use Munsell Color chart)

Soil Surface Color A Horizon	Amount of Organic Material	Erosion Factor	Aeration	Available Nitrogen	Fertility
Dark (dark grey, greyish; brown to black)	Excellent	Low	Excellent	Excellent	Excellent
Moderately Dark (dark grey, dark brown; to dark yellow-brown)	Good	Medium	Good	Good	Good
Light (pale brown, yellow; brown to yellow)	Low	High	Low	Low	Low

Subsurface Soil Color (8 Horizon)	Condition
Dull Grey (low rainfall soils)	Water-logged soils, poor aeration
Yellow, red-brown, black (forest soils)	Well drained soils
Mottled grey, brown or yellow (humid soils)	Somewhat poorly drained soils

(3) Effects of Soil Texture

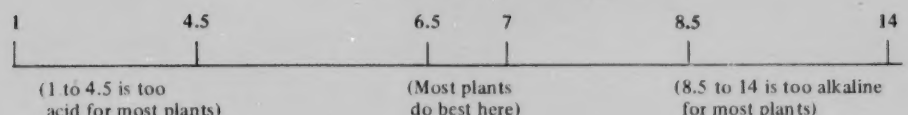
	Water-holding capacity	Looseness
Sand	Poor	Good
Silt	Best	Good
Clay	High	Poor
	(low availability to plants)	

(4) Effects of Soil Structure

Type	Penetration of Water	Drainage	Aeration
columns	good	good vertical	good
blocky	good	moderate	moderate
granular	good	best	best
platey (low rainfall soils)	moderate	moderate	moderate

(5) Effects of pH on Soil

Plants need many food elements in order to grow well. These include nitrogen, phosphorus, potash and sulphur. The amount of pH determines how readily plants can get these elements.



Example of plants in pH range:

pH 4.0–5.0: rhododendrons, camellias, azaleas, blueberries, fern

pH 5.0–6.0: pines, firs, holly, daphne, spruce, oaks, birch, willow

pH 6.0–7.0: maple, mountain ash, pansy, asters, peaches, carrots, lettuce

pH 7.0–8.0: beech, mock orange, asparagus

(6) Effects of Temperature on Plant Growth
Plants do not grow well when the soil is too cold or hot during the growing season. The following chart applies to most of the soil temperature zones.

Soil Temperature	Growing Conditions
Less than 40°F	No growth, soil bacteria and fungi not very active
40°F to 65°F	Some growth
65°F to 70°F	Fastest growth
70°F to 85°F	Some growth
Above 85°F	No growth

SOILS AND LAND USE

Objectives

As a result of this encounter the student should be able to:

1. Identify three different plant types and the soils in which they grow.
2. Describe three kinds of soil texture.
3. Construct a chart for plants growing in each type of soil texture for a period of three weeks.

Rationale

Soil varies in color, texture and components. These differences cause variation in the growth of vegetation.

Materials

3 bean seeds sandy soil clay soil silty soil paper hand lens

Activity 1

COLLECTING SOIL SAMPLES

Walk around the school grounds or its vicinity and observe the types of plants growing in the area. Determine the kinds of soils that three different varieties of plants are growing in.

By observation learn how the soils differ and how they are alike. Are they sandy, silty or clayey? Base your judgment on color and texture.

Activity 2

DESCRIPTION OF SOIL

If the three kinds of soil texture cannot be located around the school area, have students bring samples of each to class and describe the texture and colors which they believe are best for growing different kinds of plants.

Activity 3

GROWING SEEDS IN DIFFERENT SOILS

Have the students plant three bean seeds in three types of soil. Before planting, soak the seeds overnight in water. Water the plants for three weeks with an identical amount of water, and see that they obtain the same amount of sunlight. Observe changes (if any) daily at a given time and record them on a student-designed chart.

Activity 4

SUMMARIZING OBSERVATIONS

After observing and recording the growth of the plants, have the students record in written form what they learned about soil texture. Which soil holds water best? Which soil produced the best growing plant? Why? Which soil would be best for garden use? How should the soils be used in order to make the best use of the land?

Appraisal

Using the information on the three types of soil, describe what could be done to increase its potential. If possible, a field trip should be arranged to a nearby farm to see if land is being utilized to its fuliest potential.

CURRICULUM RELATIONSHIPS

Language Arts

Describe the feel of the different soil types. Describe how land can be managed for its highest potential. Describe how you would feel if you were a plant in one of the soils (a personification). Write letters to the Bureau of Land Management, State Department of Forestry, or U.S. Forest Service for information on land use in your immediate area.

Fine and Graphic Arts

Paint a picture of the soils, matching color and texture and plant life found in each soil type.

Mathematics

Chart the growth of plants using various measures; i.e., measure in inches as well as centimeters.

Social Studies

Find out how the land in your county has been used since it was settled by white men. Compare this land use to the way the American Indians of the region used land. Compare it to land uses of people in other countries.

Science

Learn what scientists have developed to add to soils to enrich them. Identify the processes through which soil is formed and degraded; i.e., rendered unusable by man.

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ROCKS AND MINERALS

ROCKS AND MINERALS IN MATERIALS

Objectives

As a result of this encounter, the student should be able to:

1. Identify different surfaces found on the school ground.
2. Describe three rocks and minerals on or near the school ground.
3. List the importance of several rocks and minerals we use.
4. Distinguish between animals, plants and minerals.

Rationale

Before children can understand why nonliving things must be conserved, they must learn that they are a necessary part of our environment. Life depends upon the interaction of the living with the nonliving world.

Vocabulary

mineral rock surface

Materials

modeling clay natural clay sand water

Activity 1

DISCOVERING DIFFERENT SURFACES BY TOUCH

Walk around the playground and list as many surfaces other than grass as you can. Use as many senses as possible to describe what you see. (Discourage tasting at this time.)

1. Is it hard or soft?
2. What color is it?
3. Does it feel warm or cold?
4. Does its temperature change when the sun shines on it?
5. Is it natural or man-made? How can you tell?
6. Can you guess from touch or sight if the materials are hard or soft?
7. Does "black top" feel hard or soft?

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Activity 2

COMPARING SURFACES OFF PLAYGROUND AREAS

Walk across the nearest sidewalk or trail and discuss the surfaces with the same line of questioning as in Activity 1.

Activity 3

EXAMINING BRICK AND STONE

Walk outside the school to examine brick and stone.

1. Is it rough or smooth?
2. Is it hard or soft?
3. What colors can you see?
4. Does it feel warm or cold?
5. Are they all the same size?
6. Why are brick walls so strong?

Activity 4

EXAMINING SCHOOL PLAYGROUND EQUIPMENT

Examine the school playground equipment. As a class project, discuss and describe in writing the various implements.

1. How do they feel?
2. Do they change temperature from morning to evening from a hot day to a cold one?
3. Are they soft or hard?
4. Do they have different shapes?
5. From what are pipes made?

Activity 5

EXAMINING AN AUTOMOBILE

Examine the teacher's auto; discuss and record what you see.

1. Is most of the auto hard or soft? How does it feel?
2. Is the car made of the same material as the school building or the playground equipment?
3. What makes a car move? Can you tell by looking?
4. Name other vehicles that are powered by this kind of fuel.

Activity 6

EXAMINING TOOLS

Ask the custodian to bring some of his tools to class and explain their importance to his work. Tell all you can about his tools as a class project. Are they made of materials used in construction around the school?

Activity 7

MAKING BRICKS

Have the students make a brick. Gather clay from a natural clay bank and sand from a river bank. Mix the two with water. Shape into a desired form. Bake in a kiln, oven, or in the sun.

Activity 8

MINERALS

List rock and mineral types found around the playground. Discuss how minerals help us.

Appraisal

Draw a picture of three different kinds of rock and minerals found on the playground. Tell the class about three kinds of minerals and their use.

Describe how bricks are made.

Tell how the custodian's work has been made easier because of the use of rocks and minerals.

CURRICULUM RELATIONSHIPS

Language Arts

Write a story about brick after investigating how it is made. Write a short poem about minerals and/or the use of minerals. Write a story about the use of various minerals.

Fine and Graphic Arts

Draw pictures of the school ground equipment. Make some things using clay.

ROCK OUTCROPPING

Objectives

As a result of this encounter, the student should be able to:

1. Describe the characteristics of a rock outcropping and suggest its type (metamorphic, igneous, sedimentary) based on specific criteria.
2. Suggest at least one possible commercial use for this type of rock.
3. Suggest how the rock became exposed.

Rationale

From rocks we get much of the soil which sustains life. There are places where bed rock sticks out from under its soil cover, revealing its structure and makeup. Many things can be determined by studying rock outcroppings. Some knowledge of metamorphic, igneous and sedimentary rocks is a prerequisite for this activity. This basic information is available in an encyclopedia.

Vocabulary

sedimentary metamorphic igneous erosion outcrop

Materials

hand lens G-pick and chisel shovel pocket knife sketching materials

Activity 1

OUTCROP OBSERVATION

Locate a rock outcrop and study the area around it. Try to find answers to the following questions: Why is this rock sticking out and not covered by soil? Has the soil eroded away? Is there a stream or river that has cut down through it? Has man cut into it to make a road? Is man extracting rock from it as a quarry? Was it pushed up by some kind of volcanic action?

Activity 2

OUTCROP INVESTIGATION

Take a close look at the rock itself. Is it hard? How hard? Can you scratch it with your fingernails or a knife? Does it have layers? Is it all one color? Is it fine or coarse grained, sandy, pebbly, gravelly, or a combination of any of these? Is it dark or light in color? What do these characteristics tell you about the type of rock?

Using your G-pick and chisels, chip off samples to take back to the classroom for future use. Look very closely at the fresh break and inspect it with the hand lens. You will be able to see the grains and crystals much more clearly.

Activity 3

OUTCROP UTILIZATION

Take the students to an area appropriate to a discussion of the following points: Are there any possible uses for this kind of rock? From what you know or can find out, could this rock contain mineable minerals? If so, would they have to go through a refining process before they were usable? Are there any refineries or smelters in your area or would the minerals have to be sent a long way? If there are no mineable minerals, can the rock be used commercially for anything such as building, blocks, gravel, or concrete? Is the ground in this area being used for a better purpose or could it be?

Appraisal

Write a description of the area visited which covers the three problems in the objectives—observation, investigation, utilization. Have students suggest means to prevent erosion.

CURRICULUM RELATIONSHIPS

Fine and Graphic Arts

At the rock outcrop sketch or paint the area.

Language Arts

Write a prose or poetic impression of the area.

Social Studies

Take a close look at the community around your school. With the help of a geological map determine what kinds of rocks are found under the buildings. Is this a type that forms a good foundation for building? Are there problems arising from buildings resting on unstable rock? How would one go about learning what type of rock is underneath an area where building is planned?

Science

What measures, if any, would help keep the soil in the area stable?

ECOSYSTEMS

OBSERVATION OF A MINIATURE ECOSYSTEM

Objectives

As a result of this encounter, the student should be able to:

1. Identify places where soil supports plant life.
2. Identify animals or signs of animals living in the soil.
3. Describe living and nonliving things found at different soil levels.
4. Record the types and number of plants and animals observed in a given area.

Rationale

An ecosystem is composed of living plants and animals and nonliving components such as soil, air, and water. See Part I of the handbook. All interact with each other and are essential to maintain the life of the community.

Every human being is an integral part of an ecosystem.

This encounter is designed to show the dependence of one organism upon all the others in its ecosystem.

Vocabulary

biotic ecosystem organic inorganic

Materials

paper
pencil
glue
hula hoop or marker equal in size to a square foot
cardboard
hand lens

Activity 1

OBSERVING A PLOT OF GROUND

Take the students to the school grounds or wherever there is at least a square yard of earth for observation. This area of living and nonliving things constitutes an ecosystem.

Have the students observe the area with hand lens, then make a record of living and nonliving (organic and inorganic) things, and the number of each which can be seen on the surface of the ground. Discuss with the group:

1. How many different kinds of animals they saw.
2. How many kinds of plants there are in the area and why there are no more.
3. Ways in which these plants and animals benefit each other by living together.
4. Indications that the soil can support plant life.

Activity 2

OBSERVING SOIL COMPONENTS

Take the students out of doors. If possible, return to the place where Activity 1 was conducted. Have each student again observe the organic and inorganic things found in the soil at a depth of one-half to two inches.

Discuss as a group:

1. How the organic and inorganic things found beneath the soil differ from those on the surface.
2. What, if anything, they add to the soil.

Activity 3

ART AND WRITING

Have the students collect decayed and nonliving things and mount them on cardboard in the form of a collage. Have them write a cinquain about the collection. A cinquain is an unrhymed poem of five lines, with two, four, six, eight, and two syllables in each line successively. For example:

The soil
Is rich and brown.
Decomposing for change,
It gives home and food. In short, it
Gives life.

Have a student pick an area and study its ecosystem. Compare this area with the one observed on the school ground. How are they alike? How do they differ? Are the same plant and animal types found in both?

CURRICULUM RELATIONSHIPS

Science	Find out the names of the plant and animal life observed, and what happens to the soil over a given period of time.
Mathematics	Prepare a graph showing the number of organisms by soil depth. Calculate the ratio between animal and plant life in one square yard of land. Does this ratio always hold true? Can you offer a reason for this?
Social Studies	Top soil is a priceless item. Contact governmental agencies and attempt to find out what conservation techniques are employed in Oregon to maintain top soil.

TREES AND PLANTS

GETTING ACQUAINTED WITH TREES

Objectives

As a result of this encounter, the student should be able to:

1. Draw a chart showing deciduous and coniferous trees, their shapes and leaves, in winter and summer.
2. Name four characteristics all trees have in common.
3. Describe a tree's appearance in each of the four seasons.

Rationale

Trees serve an important function in our personal lives as sources of recreation and pleasure, and they are an important element in the state economy. Oregon is the leading lumber producing state in the nation.

Vocabulary

deciduous coniferous identification key sapling seedling

Materials

tree samples red paint

Activity 1
Shapes

THINGS TO DO WITH TREES

Observe and compare the shapes of trees. How many different shapes can you find in the trees in the school yard, in the city park, in a favorite woodland hike? Are the shapes triangular, column-like, evenly tapered, low and spreading, regular, irregular? Find two trees with distinctly different shapes and sketch them.

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Branches

In how many different directions do trees branch? How do the branches grow out from the tree—straight out, out and then down, out and then up at the ends? Find two trees whose branches grow differently and sketch them.

Foliage

How many different textures of foliage do you observe? Do the leaves grow up from the branches or down? Do they grow all along the branch or only at the ends? Do they hide part of the branch? Find two trees with different textures and sketch your impression of them.

Colors

How many different colors do you find in the bark and leaves of trees? Observe a tree at various times on a sunny day and compare the light patterns. Sketch the designs and patterns made by the shadows of trees.

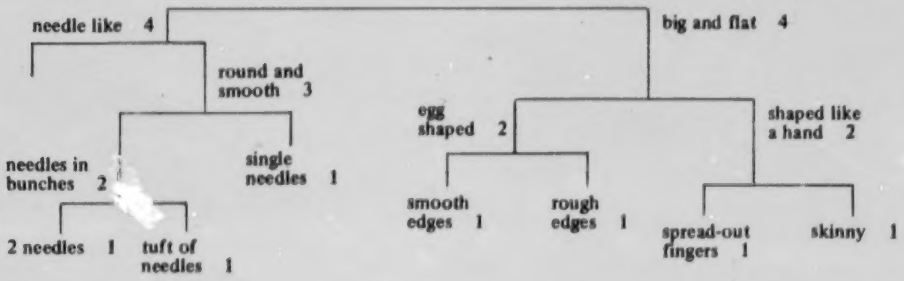
Bark

How many different textures can you find in the bark of trees? Make bark rubbings on paper with crayon.

Activity 2

CLASSIFYING LEAVES

Bring eight to ten leaf samples to school. Lay them out on a large table, and ask the students to divide them according to this sequence of differences: color, feel, shape, and size. (The sequence may be varied.) Have the students state the reasons for their division. Then have them continue to subdivide until only one leaf is in each group. Construct with them, in chart form, a dichotomous key for identifying these leaves. It might look like the following:



Then take a walk around the neighborhood, finding other leaves, and put them in their place on the key.

Activity 3

OBSERVING AND IDENTIFYING PARTS OF TREES

Have the students observe trees on the school ground or in the neighborhood. Ask them to crush a leaf and smell it. Have them lie on their backs under the tree and look up, then at the ground under the tree. Do they see the roots sticking out above ground? Have them identify the various parts of a tree as in Activity 2.

Activity 4

MEASURING TREE GROWTH

Early in the fall, have your class "adopt" two small live trees growing as near to the classroom as possible; one should be deciduous and the other a conifer. Let them devise their own names of the trees such as "hand-shaped leaf tree," "two-needle tree," "white bark tree." Make a list of observations about each following guidelines in Activity 1. Measure the tree's height and its trunk circumference at ground level. Mark trees with red or white paint at the end of a branch, and periodically through the year record changes in shape, color, height, and other characteristics.

Appraisal

Predict how big the two adopted trees will be in 10, 20 or 50 years. Relate this to students' growth.

Students choose a tree they would like to have in their own yard and tell why.

CURRICULUM RELATIONSHIPS

Language Arts

Write a description of a leaf. Write a haiku or cinquain about a tree.

Fine and Graphic Arts

Make a detailed sketch of leaves, bark, twigs. Compile a series of drawings of "adopted" trees through the seasons. Make drawings of bark, charcoal, leaves, flowers using only natural materials.

Mathematics

Keep a detailed record of growth of a tree with a graph. Use a calendar in recording data.

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Knowing Your Trees. Washington, D.C.: American Forestry Association, 1965.

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USES OF TREES

Objectives

As a result of this encounter, the student should be able to:

1. Name three kinds of food we get from trees.
2. Name two products other than food we get from trees.
3. Identify three ways trees help moderate weather.
4. Identify two ways in which trees improve the soil.
5. Describe aesthetic values of trees.

Rationale

Our children need experiences that will lead them to the discovery that trees should be protected because they are both useful and beautiful.

Vocabulary

lumber board feet diameter windbreak humus aesthetic

Materials

sample crosscuts of a tree
containers to collect rainfall
old Christmas tree
bean seeds

Activity 1

TREES AS A FOOD SOURCE

Take the students for a hike around the school yard, neighborhood, or nearby woods. Say "Let's look for animals whose homes are in or near trees." As these animals are observed, look for their sources of food. Where do these things grow? Do we eat anything that grows on trees? Try to find nut and fruit trees.

Provide two edible products from trees and arrange for the class to sample them.

Activity 2

WOOD PRODUCTS AND OCCUPATIONS

Discuss with students what their fathers do. How many are connected in some way with the forest products industry? Walk around the neighborhood and observe what the houses are built of. Have them list everything in the classroom that is made of wood. Make a large mural showing products made from wood, or make a collection of different kinds of wood. Read in class accounts of medicines such as quinine that are derived from trees.

Activity 3

DETERMINING AGE OF TREES

Look at a crosscut of a tree or stump. Have students deduce what rings mean and then count them, thus determining the approximate age of the tree.

Activity 4

TREES AS SHADE

On a warm sunny day, take the class outside to a sunny spot away from trees. Ask the students how they feel. The suggestion will probably be made that the group move to the shade. Walk around and look at different trees, let children decide where to sit. Which side of the tree is shady? What size and shape of leaves give the most shade? Sketch sun and shadow pictures.

Activity 5

TREES AS SHELTER

On a rainy day, set out two containers to collect rainfall, one under a tree, one in the open. Compare the results.

Activity 6

TREES AS WINDBREAK

On a windy day, observe the wind first on the leaves and branches of an unprotected tree, and then on a tree in the midst of a grove. Why do people use trees as windbreaks?

Activity 7

TREES AND TEMPERATURE

Periodically during the year take the temperature of the air and the soil in an open spot and under a big tree. Record the data in graph form. Do the lines move together? Make observations of the effect of a tree on temperature. Discuss the findings.

Activity 8

TREES' EFFECT ON SOIL

Take samples of soil from the school ground–some from an open spot and some from under a tree where the humus is obvious. Plant bean seeds in each sample. Observe and record plant appearance and growth.

Activity 9

PRESERVATION OF TREES

Play a simulation game with the students. The problem: Some trees must be cut down on the school ground. One group can be the school board giving reasons for the cutting, another group foresters deciding which trees should be cut, another group citizens trying to save the trees.

CURRICULUM RELATIONSHIPS

Language Arts

Write a creative story about what our school room would be like without any wood. Write a history of the life of a tree, say, a Douglas fir or ponderosa pine.

Fine and Graphic Arts

Draw a food chain involving a plant or tree living on the school ground. Make crayon rubbings of cross sections of trees.

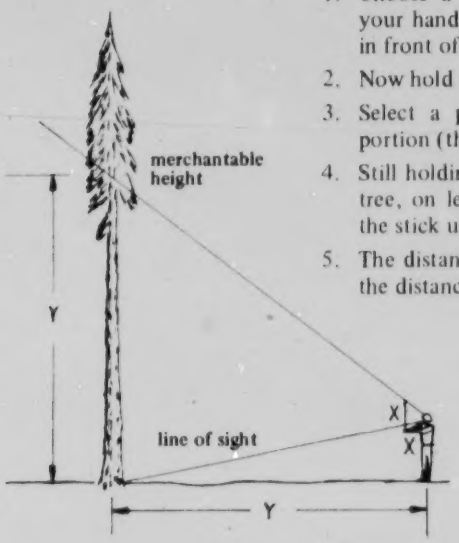
Social Studies

Learn about the significance of the forest products industry in Oregon. If there is a situation involving the destruction of trees for a new highway, housing development, or other changes in your community, learn the facts, write letters to concerned agencies, become involved!

Mathematics

Learn how to estimate the height of a tree with a stick. Learn measurements of rainfall activity and draw monthly charts.

INSTRUCTIONS FOR MEASURING MERCHANTABLE HEIGHT OF TREE



1. Choose a stick the same length as the distance from your hand to your eye with your arm held out straight in front of you, parallel with the ground.
2. Now hold the stick upright to form a right angle.
3. Select a point on the tree where the merchantable portion (that usable for lumber) seems to end.
4. Still holding the stick upright, walk backward from the tree, on level ground, sighting across the upper end of the stick until the cutoff point comes into view.
5. The distance from the tree base to the viewer will equal the distance from the base to the cutoff point.

Appraisal

Write a poem about a tree you like.

Describe what life would be like if there were no trees.

TREE IDENTIFICATION

Objectives

As a result of this encounter, the student should be able to:

1. Classify trees as broadleaf or conifer.
2. Identify common trees in the community by shape, bark, leaves, seeds, and other distinguishing features.

Rationale

Since trees are vitally important in the economic and recreational life of the Pacific Northwest, students should be able to identify them.

In this lesson a tree can be defined as a woody plant at least eight feet tall having one well-defined stem and a more or less definitely formed crown.

Vocabulary bract bundle lobes leaf leaflet conifer broadleaf species

Materials magnifying glass leaves and seeds as needed

Activity 1

OBSERVING TREES IN DIFFERENT SEASONS

Ask the students to observe trees at different seasons of the year. Discuss some of the signs they should look for. Have them sketch and color their favorite trees in winter, spring and fall. Pictures can be used on a bulletin board.

Activity 2

IDENTIFYING TREES

Have students take a pad and pencil on a nature walk. What do you observe about the first tree that will help you recognize another of this species?

Have each student develop a key or ways he would identify certain species. Students should discuss each tree as it is observed, and they should make an identification key under such headings as Tree 1, Tree 2, and Tree 3.

Ask students to bring to class parts of a tree, such as a branch with leaves, a leaflet, a cone, a seed, or a flower. Have each one make an identification key naming the tree and listing unique features he observed about it. Sketch the shape of the tree. The identification key should be on the sketch.

Coniferous trees, also called evergreens, are green the year round. Broadleaf trees lose their leaves in the fall after growth has stopped.

Fir, spruce, hemlock, cedar and pine are coniferous trees which remain green throughout the year. Maple, oak, poplar, cottonwood, willow, walnut, chestnut and locust are common broadleaf or deciduous trees. See *American Trees: A Book of Discovery*, by Rutherford Platt, pages 149-198.

Classify the trees students have sketched.

Have each student make a tree map for the block in which he lives, showing the number and position of conifers and broadleaf trees, identifying them by the letters C and B.

Activity 3

A FIELD TRIP

Take a field trip to a woodland tract, county or state park, or national forest. This will give students opportunities for identifying trees and seeing them in natural surroundings. Have them bring along a tree identification book. The trip may be preceded by showing a filmstrip suitable to the student age group.

Appraisal

Suggested means of appraisal: Ask a few students at a time to choose three specimens placed on the table in the classroom and identify them, indicating the identification key being used.

Give students a mimeograph sheet of leaf structures and seeds—see pages 231-242 in *American Trees* and ask them to match the names with the pictures. Write C for conifer and B for broadleaf.

OBSERVING SEEDS

Objectives

As a result of this encounter, the student should be able to:

1. Describe the function of seeds.
2. Describe three stages in a seed's development.
3. List four things necessary for a seed to grow.
4. List three ways seeds are carried from place to place.

Rationale

The importance of plant life and the processes by which reproduction occurs in order to continue the species should be an essential part of basic education. Observing and studying seeds will help students realize that some natural resources, such as plants, may be replenished through wise use and management.

Vocabulary seed germinate cone sprout species deciduous nutrient embryo

Activity 1

OBSERVING VARIOUS KINDS OF PLANTS

Find a suitable place on the school ground or in a nearby park for a class discussion. Observe various plants growing nearby. Try to determine the origin of the wild plants.

Collect seeds from flowers. Have the class discuss the function of seeds. Point out that every seed produces a specific kind of plant which in turn produces more seeds of the same variety, thus insuring continuation of the species.

Activity 2

COLLECTING AND EXAMINING SEEDS

Collect cones and examine the place where the seeds are found. Pine, fir or alder cones can be found in most parts of Oregon. Discuss:

1. How seeds leave the cone and reach the ground.
2. The number of seeds found in each cone.
3. What happens to each seed.
4. What kinds of animals use cone seeds for food.
5. What conditions are required for seeds to germinate.
6. Why plant growth is important to animals.

Activity 3

SEED DISPERSAL

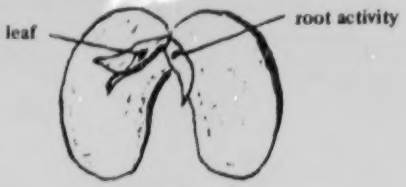
Take a walk around the grounds of the school or your home neighborhood. Find a deciduous tree—such as a maple with its seed pods (each propeller holds two seeds). Discuss how seeds reach the growing area and how they germinate.

Search for a thistle and/or a wild flower and discuss where its seeds are found and how they are dispersed. How do these seeds get from one place to another?

Activity 4

COMPONENTS OF A SEED

Bring a packet of radish, bean, or pea seeds to class. Because of their size, beans work best. Soak a few seeds for at least four hours, then split them. The children will be able to observe the plant embryo. Point out the future leaves and root. See illustration.



Bean Half

Place a paper towel in a shallow glass bowl, dampen and spread the seeds upon it. Keep the towel damp, not wet, as the days pass. It is not necessary to keep the seeds in sunlight.

Make daily observations of seed germination and growth. Ask the students to determine where the nutrients for the embryo come from.

CURRICULUM RELATIONSHIPS

Science

Demonstrate what happens to seeds if one of the necessary requirements for growth is missing, or where overcrowding is evident.

Dramatic Arts

To dramatize the study of seeds, present an original play using such characters as Mr. Weatherman, Farmer Brown, Raindrops, Jack Frost, Children, Mr. Cloud, Mr. Sun, and Miss Air.

RELATIONSHIPS AMONG INSECTS AND PLANTS

Objectives

As a result of this encounter, the student should be able to:

1. Identify (using a key) insects common to the local area.
2. Group the insects as carnivores, herbivores, or omnivores.
3. Group the insects (and other organisms) according to their beneficial or harmful relationship to a specific plant.

Rationale

While major communities are fairly self-contained, minor communities are dependent on neighboring ones and on a constant fluctuation of organisms. This investigation should create an awareness and appreciation of the interaction that occurs between some organisms in a minor community.

Vocabulary

taxonomic key	community
producer	herbivore
carnivore	omnivore
ecology	minor community

Materials

hand lens	large plastic bag, with tie
note pad and pencil	small jar of alcohol
taxonomic insect key	ether (finger nail polish remover), cotton

Activity 1

OBSERVING INSECTS ON A PLANT

Select a common deciduous herb (1 to 2 feet high) in an area that is relatively natural or where a limited amount of pesticide has been used. The plant should have a large insect population (some plants repel insects). Using the hand lens, carefully observe the insects on the plant and record their relationships. At this point name the insect species. Move back so as not to interfere with the community and observe organisms that visit the plant. Record the outcome of the visits. Observations at different times of day are helpful in obtaining a better idea of community interaction.

Activity 2

COLLECTING INSECTS

Gently place a plastic bag over the plant and secure it around the base. Cut the stem. Put an ether soaked piece of cotton in the bag with the insects. Shake the anesthetized insects off the plant and from the bag into a jar of alcohol. Using a hand lens or dissecting scope and key, identify the insects according to order. Record the number of each species.

Appraisal

Discuss ecological relationships among insects and plants, especially trees. Discover if there are any insect blights in forests in your part of the state, and what is being done to combat them. The division of forest pathology of the U.S. Forest Service Regional Headquarters in Portland will provide information, but you can also contact the nearest Forest Service office; the State Department of Forestry in Salem; and the Bureau of Land Management, State of Oregon, office in Portland.

CURRICULUM RELATIONSHIPS

Social Studies

Assign to students a study of economic losses caused by insect damage to agricultural or forestry concerns in your county.

Science

Have students compile life histories of insects that are doing considerable damage to the state's crops or forests. Information may be obtained from the County Extension Agent or the U.S. Forest Service (see Appraisal).

Have students investigate the uses of pesticides and herbicides in Oregon agriculture. Information is available from the State Department of Agriculture, Salem. What other controls on crop pests are being used now?

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Books

The Insects. New York: Time-Life Books, Inc.

Swain, R. B. *Insect Guide.* New York: Doubleday and Company. 1948.

STUDY OF A COMMUNITY - A ROTTEN LOG

Objectives

As a result of this encounter, the student should be able to:

1. Identify the animal and plant life found in a rotten log.
2. Describe the decomposition of a rotten log.
3. Describe in pictures and words the biotic relationships in a rotten log and their effects on the immediate area.

Rationale

A decaying log is a world in itself where plants and animals live and die, and where organisms continue from one generation to the next. This exercise illustrates that the log is a community in itself, an ecosystem. The dependence of each organism on others and on the log illustrates the relationships in any ecosystem, big or small.

Vocabulary

community ecosystem decomposition biotic

Materials

hand lens paper cardboard pieces pencil

Activity 1

OBSERVING A ROTTEN LOG OR STUMP

Study a rotten log or stump. What do you see? What smells are you aware of? Can you hear anything? Are some portions soft?

Activity 2

RECORDING OBSERVATIONS

Instruct the students to record the number of plants they see near the log as well as evidence of plants and animals in or on the log. Where are the plants located? What effect did they have on the log? What foods do animals eat? How are these plants and animals related? How do they depend upon each other? What would happen if some plants or animals were destroyed?

Activity 3

A STUDY OF DECOMPOSITION

Have the students observe the different stages of decomposition in the log. To show the different stages of decay, a student can collect small specimens to mount and label on a cardboard.

How many stages can be found? What will this log eventually become? How will it change the soil around it?

Activity 4

ART AND CREATIVE WRITING

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Have each student choose a place where he can see a tree stump and, using only natural materials (bark, leaves, flowers), create a picture of it. Have the students write a poem about a rotten log and the activity that goes on within it.

Appraisal

Have students explain in words or pictures how a rotten log is a small community in itself.

CURRICULUM RELATIONSHIPS

Science

Identify the different trees, plants and animals observed in an area familiar to students.

Social Studies

Investigate the role forests have played in our state's development and what is being done to sustain forest growth and the industries dependent upon it. Some questions: How were the forests logged in the early 20th and 19th centuries. How are they logged today? What is meant by clearcutting? What kind of state laws regulate forest practices? What agencies manage the federal forests in our state? The state forests? How did the national forests originate?

Language Arts

See Activity 4.

Fine and Graphic Arts

See Activity 4.

Mathematics

Prepare three graphs comparing plant types, animal types and ratio of plants to animals in an area familiar to students. Develop a discussion on the measurement of lumber and timber, centering on board feet, round timber, and similar terms which may be found in a silviculture handbook.

MARINE AND FRESHWATER LIFE

THE WATER CYCLE

Objectives

As a result of this encounter, the student should be able to:

1. Demonstrate that the alternating process of evaporation and condensation produces a "water cycle" in which water changes from one form to another and back again.
2. Demonstrate that water is present in the air, soil, and all living things.

Rationale

More than half the earth's surface is covered with water, and without water life as we know it could not exist. The earth's supply remains constant and is always on the move. It travels from clouds to land and ocean and back to the sky, a process called the water cycle in which we use the same water again and again.

As water falls upon the earth, part evaporates, part enters the soil, and part runs off over the surface into streams and eventually to lakes or the sea. Of the water that enters the ground, most is held in the soil where it is used by plants or evaporates. In either event, it returns to the atmosphere as vapor. When water passes into the atmosphere, it eventually forms clouds and falls as rain, snow, hail, or sleet. This completes the water cycle.

Vocabulary

evaporation condensation water vapor

Materials

3 foil 8" pie plates
1 cup sand
1 cup soil
1 cup water
1 sheet 8" x 10" drawing paper
1 paper towel
1 piece of cloth 8" x 10"
2 clear dry glasses or jars
1 3" foil pan
1/2 cup dark soil from the ground
1 pyrex beaker 600 ml.
1 hot plate
several ice cubes
flat cake tin (approx. 12" x 18" x 3")
1 quart container for water
6 foil pie plates
12" x 18" drawing paper (class load)

Mix together:
1 1/2 quart soil
1 pint rocks and pebbles of various sizes

For clay dough:
3 lbs. flour
1 lb. salt
1/4 cup oil
6 foil pie plates
6 tongue depressors
water
measuring cup
measuring spoons

1 carrot
1 cucumber
1 potato
4 oranges
several lettuce leaves
several leaves from a house plant (begonia, jade, geranium)

Activity 1

OBSERVING THE EFFECTS OF PERSPIRATION

When the students come inside after playing on a hot day, ask them to describe how they feel (damp, sticky, sweaty, hot, wet). What makes them feel wet and sticky (water)? Do not have them wipe off the perspiration but sit quietly to see what happens. While they are sitting, ask them to name all the other places where water may be found. Write responses on the board then classify them under the headings of *land, bodies of water* (including moving water) and *air.* Now ask students if they are still wet and sticky. What has happened to their perspiration? Have them keep a record of all the ways they use water during one day.

Activity 2

EXPERIMENT

Assign six students to prepare two each of the following demonstrations illustrating evaporation using pie plates of wet sand, wet soil, and water, a wet paper towel, a wet cloth, and a piece of wet drawing paper. One set of materials should be placed in a sunny spot, and the other out of the sun. On the following day, ask the students to report if any changes occurred in their displays. An inference should be made that water has evaporated from each of them and that those in the sun evaporated faster. Be sure students understand the meaning of evaporation. Ask them to name other examples of evaporation (such as drying hair, paint, or dishes in a rack). Each student may choose one example to illustrate for a bulletin board labeled "Water Goes into the Air."

Activity 3

CONDENSATION

Have two students prepare a demonstration with two clear dry glasses or jars. Fill one about a quarter full of dark damp soil and leave the other empty. Cover each glass with a dry saucer (not a tight fitting lid). The following day examine the bottom of each saucer. (There will be water droplets on the saucer covering the soil). Students should infer that the water evaporated from the soil. Ask why the water is in droplet form.

Tell the students you are going to show them how water from the air is condensed into drops. Demonstrate by boiling water in a beaker. Observe the steam rising from the water. Place the foil pan filled with ice cubes on top of the beaker. Drops will form on the bottom of the pan. Ask students what caused the steam to change to drops. How did the ice affect the temperature of the pan? They should be able to make the inference that moisture in the air which hits a cold surface condenses. Is a cold surface necessary for condensation to take place? Discuss how rain might be formed. Be sure to include the sun's role in providing heat to cause evaporation.

Activity 4

A MINIATURE LAND STUDY

At one end of the cake pan place the mixed soil and rocks in a pile which has a gradual slope on one side and levels off to simulate natural terrain. Leave empty space to represent the ocean. Pour water over the top of this pile to demonstrate the action of rain. Some water will sink into the ground and some will run down into a body of water.

Place ice cubes on top of the pile and observe what happens to the melting water. Students should infer that rainwater forms streams, sinks into the ground, collects in puddles, and sometimes carries soil and rocks.

Activity 5

A LAND MODEL

This may be used as a mathematics lesson for the day. Make clay dough for a model of a terrain which includes valleys and depressions to simulate bodies of water classified in Activity 1.

Write the following clay dough recipe on the board:

1 cup flour
¼ cup salt
1 tsp. oil
water to form a soft dough

Mix the flour and salt in a pie plate. Make a well in the mixture and put oil in the well. Stir from the center. Add half a teaspoon at a time and mix until students decide that the clay is of workable consistency.

Divide the class into groups of five. Each group is to make a batch of clay dough. Every student should have an assigned task. Four may measure the ingredients and the fifth do the mixing. All students are to observe the mixing and participate in the decision about the workability of the dough. (The total amounts of each ingredient could be computed.)

Put all the clay together to make the terrain and demonstrate bodies of still and running water. Each student should have the opportunity to choose a body of water and make a depression in the model. Let the mixture set until firm. Pour water (as rain) over the terrain to fill the depressions. Observe how long it takes the water to evaporate.

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Activity 6

STUDYING WATER CONTENT OF VEGETATION

Divide the class into six groups and place each group at a different table. Cut vegetables into small pieces and place the sections in separate pie plates. Peel the oranges and separate them into sections. Put the lettuce and plant leaves on pie plates. Give each group one of the plates. Each student may take a section from the pie plate to observe the presence of water. They should rub the leaves hard between their palms to feel they are wet, break the orange sections open to see water, and then eat them to taste the water. Groups should move from table to table.

Afterwards the class should discuss its observations, noting that water is present in all plants. Remind them about the perspiration from their bodies. Is there any other water in your body? (Wastes and other body fluids.) Do other animals have water in their bodies? Students should be able to infer that water is present in all living things.

Activity 7 (optional)

A READING

Make copies of the following verses to be used as a choral reading:

THE TEN LITTLE RAIN DROPS

10 Little Rain Drops doing just fine
I hit some bushes and then there were 9.

9 Little Rain Drops feeling just great
I came to a pretty lake and then there were 8.

8 Little Rain Drops a long way from heaven
I came to a hill of dirt and then there were 7.

7 Little Rain Drops looking for "kicks"
I dived into a river deep and then there were 6.

6 Little Rain Drops very much alive
I landed on a grassy lawn and then there were 5.

5 Little Rain Drops playful as before
I hit a little cabbage patch and then there were 4.

4 Little Rain Drops on a big spree
I ran into a clover field and then there were 3.

3 Little Rain Drops wondering what to do
I fell into a little well and then there were 2.

2 Little Rain Drops having lots of fun
I ran into some forest trees and then there was 1.

1 Little Rain drop feeling all alone
It was swallowed by a fish pond and then there was none.

Activity 8

A CLASS TERRARIUM

An empty can or a large pickle or mustard jar turned on its side can be used to make a terrarium.

Put a half-inch layer of pebbles on the bottom and half an inch of sand over the pebbles. Cover the sand and pebbles with about one inch of rich soil. Plant low growing plants such as mosses and ferns in the soil. Arrange a few rocks and pebbles and small pieces of bark and driftwood and add snails, toads, worms, or turtles. Put water into it. Keep the terrarium where it will get some sunlight. Observe evaporation and condensation taking place to show a complete water cycle.

Appraisal

Give each student a 12" x 18" piece of drawing paper. Ask the class to fold the paper in fourths and sketch and label one of the following in each:

1. The process of evaporation.
2. The process of condensation.
3. Water in living things.
4. A miniature terrain showing rain falling on land and draining into a river or lake.

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MARINE LIFE

Objectives

As a result of this encounter, the student should be able to:

1. Describe marine life in a natural habitat.
2. Sketch and describe a marine specimen.
3. Group 10 or 12 marine animals by their common characteristics.

Rationale

The ocean and its biotic components are part of the biosphere. Sea life is fascinating and diverse and every marine habitat has its food chain and life cycles. A tidepool study will show many of the wonders of the sea.

Vocabulary

tidepool camouflage biotic biosphere

Materials

paper pencil buckets nets hand lens

Activity 1

A FIELD TRIP

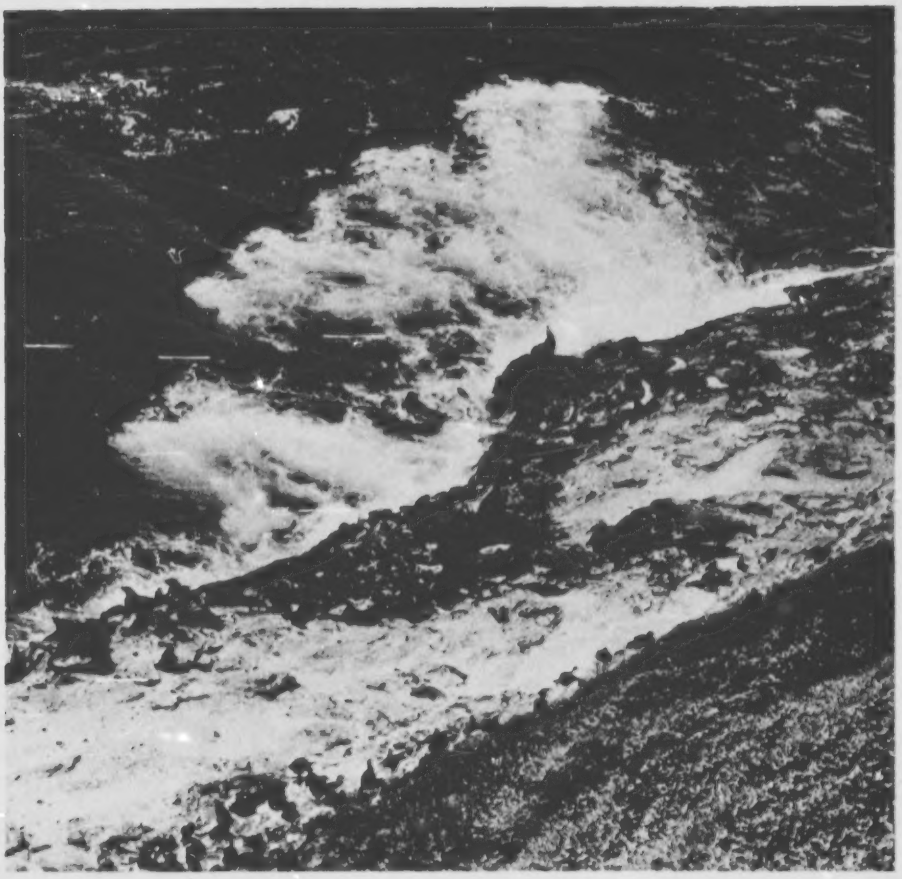
Plan a trip to the seashore. Buckets, nets and hand lenses are needed so that animals collected can be observed closely. Students should be organized into small groups with a bucket available to each group. Every group should be accompanied by an adult. Before arriving at the tidepools, make sure that the children are wearing tennis shoes to protect their feet. Establish safety rules before the field trip. Children should study in areas away from incoming waves. An adult should be assigned to watch for hazardous conditions.

Observations should be made only during a low or minus tide. Specimens may be found not only in the water but under the rocks. Only one of each should be studied and then returned to its habitat unless it is dead. Collecting tidepool animals is regulated by law, so special permits may be necessary.

Activity 2

DESCRIBING MARINE SPECIMEN

After studying the specimens, the groups should discuss where they were found, their coloration and food. Have each student pick one animal and draw it carefully. Then write accurate descriptions. Specimens should be returned to approximately the same place where they were found.



Activity 3

PERSONIFICATION WRITING

On the beach or back in the classroom have the children write a story pretending they are one of the animals in the tidepool and describing a typical day. A picture could also be drawn and the stories put into a "Tidepool Book."

Appraisal

In the classroom, have every student describe orally, as accurately as possible, one of the marine animals he specially likes, considering such things as its size, coloration, adaptation to the environment, manner of locomotion, food gathering, shelter, and territory it occupies. A helpful book is *Introduction to Seashore Life,* by Joel W. Hedgpeth, University of California Press, paperback.

The description should be detailed enough so the animal can be identified by the students quite easily from their experience on the field trip.

After students have given their description, ask them to form small work teams and group the animals any way they see possible: by movement, food habits, color, and other characteristics.

CURRICULUM RELATIONSHIPS

Language Arts

Write a story about tidepools, including the relationship of marine animals and plants. Rachel Carson's *The Sea Around Us* is a useful guide.

Fine and Graphic Arts

Make a marine collage using materials collected at the seashore such as seashells, agates, starfish, limpet shells, clam shells, and seaweed.

Social Studies

Find out how the Oregon shores have changed in recent years and how the laws safeguarding the beaches for the public have been helpful in saving the shores for public use. Look into the problem of estuaries, such as those at Coos Bay and Yaquina Bay, and how they have

been used and misused. Has there been much oil pollution around Oregon waters? What effect does oil pollution have on marine life?

Information can be obtained from the State Game Commission, State Department of Environmental Quality, Oregon Fish Commission, and the Oceanography School of Oregon State University.

Investigate the importance of marine fisheries, especially salmon, in the economy of Oregon. State fish and game agencies will provide helpful information. Also see the Oregon Blue Book, issued biennially.

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Whitney, Jack and Marion. *Seashore Life on Rocky Beaches of the Central Oregon Coast.* Healdsburg, California: Naturegraph Publishers, 1968.

STREAM STUDY

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Objectives

As a result of this encounter, the student should be able to:

1. Describe observations made at a stream site using three or more senses.
2. Predict and measure stream and air temperatures.
3. Measure the pH and oxygen content of the water at two different locations.
4. Identify and describe three animals living in the stream.
5. Interpret the data and infer how the information will be of help to improve the stream.

Rationale

All plants and animals need water in order to survive. The quality of water; i.e., the oxygen content, temperature, and pH, affect the plant and animal life of the community.

Vocabulary

pH reading oxygen reading

Materials

metal tipped thermometer
hand lens
work sheets
stream life animal identification kit
pH and oxygen kit (Hach Chemical Company, P.O. Box 907, 713 South Duff, Ames, Iowa 50010, or through U.S. Forest Service)

Activity 1

A STREAM VISIT

Take the class to a stream (river or creek) and have each student sit down and write as many things as he can observe, using as many senses as possible. Limit the observation time (three to five minutes), and ask the students to share with the class what they have seen.

Activity 2

MEASURING TEMPERATURES

Have the students predict how air temperatures and water temperature may be different or alike and tell why before the actual measurements are taken. Have students place a metal-tipped thermometer in the water at two different levels and compare the water temperature with air temperature. The information might be recorded on a chart.

Activity 3

pH AND OXYGEN READINGS

Using the kit, have students find the pH and oxygen content of the stream and record it on the work sheet. Readings should be measured at two locations.

An oxygen reading indicates the number of parts of oxygen to a million parts of water. A reading below 4 indicates the water may be polluted and not usable. For comparison, the Willamette River has been closed to public and industrial use when the reading was 2½ parts of dissolved oxygen to 1 million parts of water.

The pH indicates whether the water tends to be more acid or alkaline. Neutral appears at 7 on a scale reading from 1 to 14, 1 being most acid and 14 most alkaline.

Activity 4

IDENTIFYING ANIMALS

Using the same stream, have students with hand lens carefully lift the rocks and observe animal life underneath. Petri dishes make good containers, and the insects can then be kept in water and observed through a stereoscope. Have the students use the identification sheets of aquatic insects and organisms to identify three animals. Rocks must be returned to their original location, and all specimens should be carefully returned to the water.

Appraisal

Have students, using the information on the work sheet, interpret the data collected through group discussion. After the information has been interpreted, ask them "Why is it important to know this and how can it be used to improve the stream?" Record answers on paper.

CURRICULUM RELATIONSHIPS

Science

Investigate the stream in two locations some distance from each other (ideally at its source and mouth) and compare the results.

Language Arts

Write about the sounds of the stream, using words that sound like moving water (e.g., swish, gurgle).

Fine and Graphic Arts

Make a model of part of the stream that is especially pretty, using natural material such as bark, grass, leaves, rocks, earth.

Social Studies

Find out if the stream has been polluted and if so, the source of pollution. What can be done to reduce pollution? What can the class do to stop people littering and fouling the area? If possible, have a clean-up campaign for the stream area.

BIBLIOGRAPHY

Books

Milliken, Margaret, Austin Hamer, and Ernest McDonald. *Field Study Manual for Outdoor Learning.* Minneapolis: Burgess Publishing Company, 1969.

Following are record forms, descriptions and illustrations which can be used in stream studies.

STUDY OF A STREAM

Take water samples from different areas:

(1) Location of sample (Edge or middle of stream)	Time Taken	(2) temperature Water	Air	(3) pH	(4) Usable Oxygen (ppm)

Analyzing the data: Use the charts below to determine the types and amounts of aquatic animals you would expect to find in the stream.

Temperature		Life Found
Greater than 65°		Much plant life, catfish, carp
Less than 65°	Upper range	Caddis fly, water beetles, striders, bass, carp, crappie
	Lower range	Trout, caddis fly, stonefly, mayfly

pH RANGES THAT SUPPORT AQUATIC ANIMAL AND PLANT LIFE

Most Acid	Neutral	Most Alkaline
1	7	14

6.5 _____ 7.5
Largest variety (of animals, trout) (mayfly, stonefly) (caddis fly)

7.0 _____ 9.0

Snails, Clams

6.5 _____ 8.5

Bass, Crappie

6.0 _____ 9.0

Carp, Suckers, Catfish, some insects

6.5 _____ 12.0

Plants (algae, rooted, etc.)

1.0 _____ _____ Bacteria _____ 13.0

Usable Oxygen in ppm Reading	Life that can Survive
Below 5	Less variety of life
Above 5	Large variety of life

RECORD OF ANIMAL LIFE

Use the aquatic insect keys to help identify animals collected.

RIFFLE		POOL	
Kind	**No.**	**Kind**	**No.**

Conclusions:

Is this the type of aquatic life you expected to find?

_____

_____

What fish would you expect to find in this section of the stream?

_____

_____

Is the water in the stream pure enough to drink?

_____

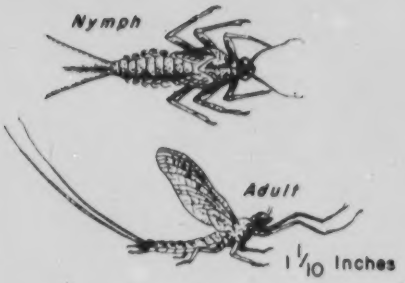
_____

How can you tell?

_____

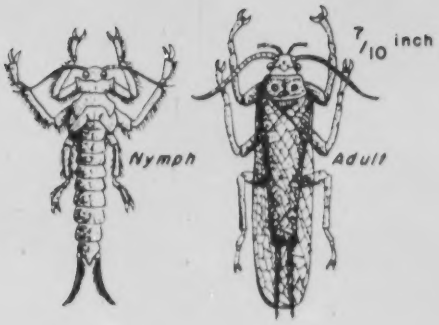
_____

AQUATIC INSECTS



1. MAYFLY

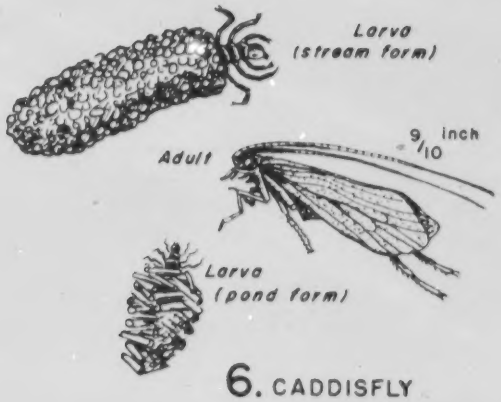
2. DRAGONFLY



3. STONEFLY

4. WATER BOATMAN

5. WATER STRIDER



6. CADDISFLY

IDENTIFICATION OF AQUATIC INSECTS

May Flies (Ephamerotera) May flies are abundant in streams and lakes and can be found in practically all fresh water bodies throughout the state. The nymphs are found on the undersides of rocks or other underwater objects. They have two or three tails. The wings of the adult are held in an upright position while resting.

Dragonfly (Odonata) They are found in all types of fresh-water areas: ponds, lakes, streams, and swampy areas. The nymphs can be found crawling about on the bottom, on aquatic plants, or other underwater objects. They are one of the largest aquatic insects. Most of them are dark brown to green as young adults but later mature to brighter colors. When resting, their four wings are held outstretched.

Stone Fly (Plectoptera) Stone flies seem to require running water in which to live. They are never found in lakes except in the inlets and outlets. When the adult is resting, its wings lie lengthwise upon the back. Nymphs are found in abundance only among the rocks in streams. Stone fly nymphs have two long, stiff tails.

Water Boatman (Hemiptera) Boatmen are found in nearly all waters, particularly in slow moving waters. They swim in an erratic pattern under water. They are normally brownish in color and equipped with leathery wings.

Water Strider (Hemiptera) Water striders are a familiar sight on the surface of slow moving waters, ponds, and lakes. They resemble long legged spiders. Although equipped with wings, they are rarely observed in flight. Their color is usually brown to gray. They are often called "water skippers."

62 **Caddis Fly (Trichoptera)** Caddis flies are found in nearly all lakes, streams, and ponds. During their underwater life, they live in cases made from sticks and small particles of rock. These can usually be seen moving about on the bottom. When the adults are at rest, they hold their wings roof-like over the body. The adults are generally dull brown or black. Sometimes the larvae are called "penny winkles" by fishermen. "Periwinkle" is another common name.

Whirligig Beetle (Coleoptera) These are found on the surface of slow moving waters, where they take advantage of the surface tension. True to their names, they whirl or swim on the surface. When disturbed they frequently dive under the water. Their bodies are dark, the front legs long and slender.

Crane Fly (Diptera) The larvae of the crane fly are found in scum of shallow waters, in the damp soil along streams or lake shores, and marshy areas. The adults are never truly aquatic and may be found great distances from water. Adults look like giant mosquitoes without a beak.

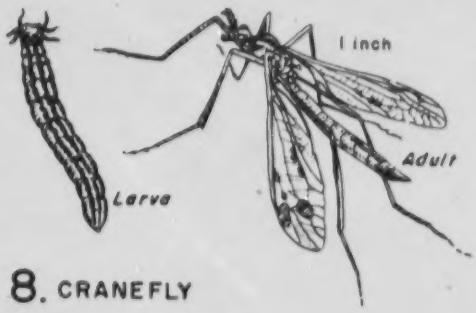
Mosquitoes (Diptera) Mosquitoe larvae are usually found in stagnant or slow moving water. Most people are familiar with the appearance of adults which are more abundant around marshy, damp areas. The young are often called "wigglers" and can usually be found wiggling about just under the water's surface. Contrary to popular belief, not all mosquitoes bite; the males are not equipped for biting.

Black Fly (Diptera) The larvae are found in flowing water only, on stones, vegetation, or other objects, usually in the swiftest part of the stream. In many cases, the larvae are so numerous they appear moss-like over the surface of the attached object. Later in life, they live in a cocoon which is customarily a boot-shaped structure. As the name implies, the black fly is usually dark and compactly built with rounded back and short, broad wings. Adults may be found great distances from water.

Midges (Diptera) Larvae are most abundant in shallow water in lakes, ponds, and streams favored by a heavy growth of aquatic plants. They prefer soft mucky bottoms as they are a bottom-dwelling species, and need this type of environment for constructing their tube-like homes. Larvae live in soft tubes. During later stages they are found in silken cocoons or gelatinous cases. The adult midges look like mosquitoes. Their antennae look like two feathers on the front of the head and they have no beak.

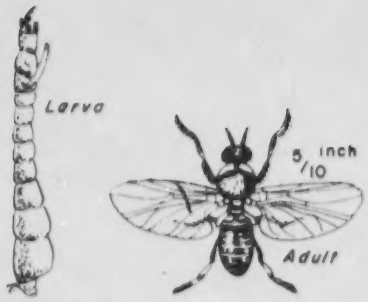
AQUATIC INSECTS

7. WHIRLIGIG BEETLE

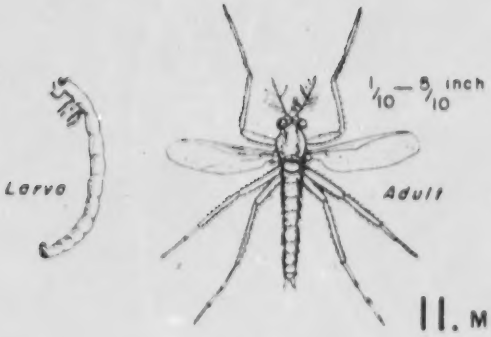


8. CRANEFLY

9. MOSQUITO



10. BLACK FLY

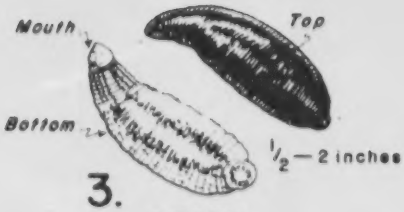


11. MIDGE

SUB-SURFACE
FRESH WATER ORGANISMS

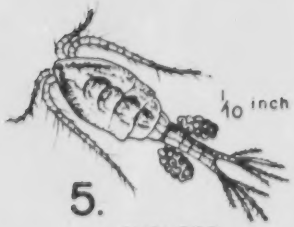
1.
PLANARIA

2. BRYOZOAN COLONY



3.
LEECH

65

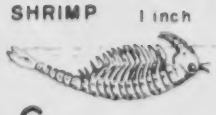


5.
CYCLOPS

DAPHNIA

4.

FAIRY SHRIMP 1 inch



6.

7. FRESH WATER SHRIMP

IDENTIFICATION OF SUBSURFACE FRESH-WATER ORGANISMS

Planaria (Turbellaria) Planarians are fairly common in ponds, lakes, springs, and other fresh water among vegetation, beneath stones, or on the bottom. These free-living flatworms are usually arrow-shaped and vary in color from white to black depending on species and environment. Small planaria look much the same as the adult.

Bryozoan Colony (Broyozoa) Fresh-water bryozoa are very common in lakes, ponds, and rivers. They are community dwellers, living in a jelly-type substance formed on sticks or over the surface of underwater objects. There is a wide range in color; some colonies are brownish and still others have a greenish tinge. Colonies consist of thousands of these tiny animals.

Leech (Hirudinea) Leeches make homes in lakes, ponds, or other fresh-water areas. They can be seen moving about under water by their well-known "Measuring Worm" type of travel, or by swimming freely. Leeches are predatory or parasitic segmented worms with sucking discs which are used in attachment, movement, and feeding. They are usually dark brown to black.

Daphnia (Cladocera) Daphnia are found in all sorts of fresh waters. The shallow, weedy backwaters of a lake whose water level is fairly permanent harbors greater numbers than any other kind of locality. These little crustaceans are virtually transparent, and are best recognized by their two-branched antennae and sharp tail spine.

Cyclops (Copepoda) These tiny fresh-water crustaceans are familiar in all slow-moving waters, especially shallow ponds. Their bodies, like daphnia, are quite transparent and characterized by the forked antenna and branched tail. The female usually has two groups of eggs attached to her body just ahead of the tail.

Fairy Shrimps (Anostraca) For the most part fairy shrimps live in temporary pools and ponds. They are frequently seen under water rowing themselves on their backs by means of numerous flattened appendages. These appendages always face the source of light.

66 **Fresh-Water Shrimp (Malacostraca)** These are found in lakes, streams, and ponds in eastern and western Oregon, usually among aquatic plants, rocks, and algae. They are nearly transparent and look like "sow bugs."

EFFECT OF TEMPERATURE CHANGES ON AQUATIC COMMUNITY

Objectives

As a result of this encounter, the student should be able to:

1. Determine the relationship between dissolved oxygen and temperature.
2. State the effect of a rise in temperature on an aquatic community.

Rationale

Since man continues to alter the temperature of both fresh and salt water areas, students should have an understanding of the effects of these practices on aquatic life. The cooling of atomic reactors and damming of rivers for navigation, irrigation and hydroelectric power are among the major sources of temperature alteration by man.

Vocabulary dissolved oxygen once-through cooling

Materials

dissolved oxygen testing kit (Hach Chemical Co.)
pond water
aquarium pump for aeration
microscope slides
gallon jars or small aquaria
thermometers
microscope

Activity 1

GRAPHING DISSOLVED OXYGEN AND TEMPERATURE

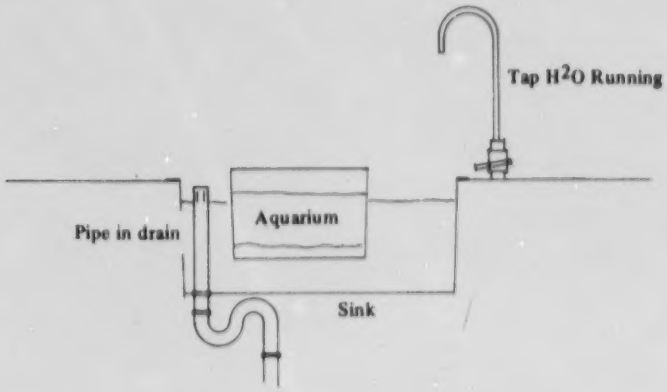
Using either pond or tap water, measure the dissolved oxygen (DO) at various temperatures from cold tap water up to 70° F. On a graph plot DO against temperature. The water should be well aerated (with the aid of an aquarium pump) during tests so temperature is the only variable.

Activity 2

OBSERVING CHANGES CAUSED BY TEMPERATURE CHANGES

Scoop up mud from the bottom of a pond, and establish an aquarium that resembles a natural ecosystem (plants, snails, small fish, algae.) Place this aquarium in a water bath that will maintain a temperature close to the natural one. (This may be done by setting a small aquarium in a sink and putting a pipe in the sink's drain and letting the tap water run slowly

at a cool temperature.) When the aquarium has stabilized at a given temperature, observe the organisms (count large ones, make slides and count and classify smaller ones) and determine their ecological relationships. Raise the temperature of the tap water. When the aquarium has stabilized at the new temperature again sample the ecosystem and determine relationships. Do this for several temperatures. Compare the composition of the community at the various temperatures.



Activity 3

MEASURING TEMPERATURE AT A DAM

On a field trip to a hydroelectric or irrigation dam record the temperature, and if possible dissolved oxygen levels, at different places below the dam and in the reservoir. What inferences can be made about the effect of the dam on the temperature of the water and its aquatic life?

Activity 4

LIBRARY RESEARCH

Read accounts of nuclear energy plants that cool their reactors by discharging the water straight into a river or lake. This process is called once-through cooling. What can you find out about the effect of this process on aquatic life, as around the Hanford, Washington, atomic plant? Is there evidence of thermal pollution and harmful radiation which affect human and animal life?

Information may be obtained from the sources listed in the bibliography of this encounter and from such agencies as the Oregon Fish Commission, the Oregon State Water Resources Board, the Oregon State Department of Environmental Quality, and the U.S. Atomic Energy Commission.

Appraisal

Discuss the relationship between temperature and food chains.

Have students predict the effect of a rise in temperature on a biotic community.

CURRICULUM RELATIONSHIPS

Social Studies

Have students write themes on the economic importance of nuclear power, the effect of the Columbia River dams on the salmon and steelhead trout fisheries. Investigate the long-range proposals for satisfying the electric power needs of Oregon and the Pacific Northwest (write to Bonneville Power Administration, Portland, for information).

Mathematics

Determine the amount of water needed to cool a plant which puts a given amount of "hot" waste into a body of water.

BIBLIOGRAPHY

Books

Curtis, Richard and Elizabeth Hogan. *Perils of the Peaceful Atom.* New York: Ballentine Books, Inc., 1969.

Novick, Sheldon. *The Careless Atom.* Boston: Houghton Mifflin Co., 1969.

ANIMALS

ANIMALS-CRAWLERS, JUMPERS, CLIMBERS AND FLIERS

Objectives

As a result of this encounter, the student should be able to:

1. Identify three or more animals that live on the playground.
2. Describe the habitat of three or more different animals that live on the school ground.
3. Recognize the effect upon animals when man changes their environment.

Rationale

Through first-hand observations, the student will begin to see the interrelationship between wild animals and other elements of the environment.

Vocabulary

habitat predator locomotion

Activity 1

OBSERVING AND DESCRIBING ANIMALS ON THE SCHOOL GROUNDS

Take a walk around the school grounds and vicinity in search of wild animals such as insects, birds, squirrels, chipmunks, frogs, and butterflies. List your observations: where you saw them, where they nest, what they eat. Spend a little time observing these animals, sitting quietly where they cannot see you. A pair of binoculars is useful.

Why do you think these particular animals live where they do? What did you see that makes you think so?

Describe from memory the physical appearance of each. What type of body cover does it have—feathers, fur? How many and what types of legs? How is each species suited physically to its environment? Is there evidence of camouflage? Point out differences in locomotion.

Activity 2

SKETCHING

Find a suitable spot on the school grounds and sketch an animal of the crawler, jumper or climber type. Also sketch its habitat. It may be necessary to put it in a jar if it is very small. Return it to its habitat when the sketch is completed.

Activity 3

LISTENING FOR ANIMAL SOUNDS

Stroll around the school grounds and neighboring area, stopping to listen to sounds of animals, such as the cry of birds, chirp of frogs, screeching of squirrels, barking of dogs, and neighing of horses. Describe your feelings when these sounds are heard.

Perhaps you can find a record of bird songs or cries of foxes and play it in class.

Activity 4

DISCOVERING HABITAT

Walk around the school grounds and surrounding area looking for evidence of animal homes in trees, on the ground, and elsewhere. Why do these animals live so close to people? In what ways can students help our animal friends?

Activity 5

DISCOVERING FOOD SOURCES

Around the school or near your home look for plant life that may provide food for animals. Examples of such food include acorns, nuts, and berries. List them and the places where they were found. What would happen to wild animals if the entire area were black topped for a playground or road?

Appraisal

From your observations describe a favorite wild animal, the food it eats, and its home. Draw a picture of one that lives in the ground and another that lives above ground (in a tree).

Discuss the effect of man's changing of the natural environment on the animals that formerly dwelled there. For example, examine the impact of roads, dams, farms, suburban housing developments. Write to the Bureau of Sport Fisheries of the Department of the Interior in Portland for a list of endangered animal species in Oregon to learn what has happened to them.

CURRICULUM RELATIONSHIPS

Science

Study in detail how animal life depends upon plant life. Illustrate with pictures.

Social Studies

Assign students research reports on the benefits to man of such animals as hawks, coyotes, eagles, and hummingbirds. In writing about coyotes try to get both sides of the controversy into perspective—that of the wildlife expert who believes that coyotes have an important role to play in the ecosystem and the cattlemen and sheepmen who believe coyotes should

be exterminated because they occasionally kill cattle or sheep. Investigate what the Oregon Game Commission is doing about predator control.

Language Arts

Write a theme on predators found in the vicinity of your community and what is happening to them. The local office of the Oregon Game Commission may be able to provide information.

Music

Play records of Songs for Animals (see below).

BIBLIOGRAPHY

Books

Pitts, et al. *Our Singing World,* the First-Grade Book. Boston: Ginn and Company, 1959.

1. The Squirrel
2. The Frog
3. Song of the Bee
4. Little Frog
5. The Butterfly
6. The Owl and the Brownies
7. A Green Frog
8. Ten Little Frogs

Berg, Richard C. Music for Young Americans, *Exploring Music.* New York: ABC Series, Book 3. 1966.

1. Muskrat Muskrat
2. Lightning Bug

Watters, Lorrain E. *Singing and Rhyming.* Boston: Ginn Book Company. 1965-67.

1. Woodchuck Hill
2. Tadpoles
3. The Little Gray Squirrel
4. White Butterflies
5. Buzz, Buzz, Buzz
6. Blackbirds
7. Bluebird
8. Honeybee
9. The Robin
10. The Empty Nest

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Audiovisual Resources

The following films are available from the Department of Audiovisual Instruction, Gill Coliseum 133, Corvallis, Oregon 97331.

Adapting to Changes in Nature
Animals in Winter
Animals Hide and Seek: Camouflage for Beginners
Small Animals Protect Themselves
Squeak the Squirrel
Animal Homes
Animals and Their Homes
Animals at Night
Animals at Work in Nature
Beaver Valley
Brown Bears go Fishing
Forest is Home to Wildlife
Adventure of the Chipmunk
Cricket and Grasshopper
Earthworm
Animals and the Way They Eat

STUDYING ANIMAL POPULATIONS

Objectives

As a result of this encounter, the student should be able to:

1. Identify and name six or more nondomesticated animals which live in or near towns and cities.
2. Identify and name six or more wild animals found only in rural areas which are largely unchanged by man's activities.

3. Identify by common names three or more animals which ordinarily can be seen only in wilderness areas, and usually at distances long enough to require field glasses to see details.
4. Discuss man's impingement in the habitat of many animals, reducing their numbers to dangerously low levels.

Rationale

Some animals need the protection and seclusion of wilderness areas. However, such areas are gradually disappearing as man develops them for his own use. Other animals vary in their abilities to live near or with man. Many persons are disturbed by the increasing number of animal species threatened with extinction, through the alteration or destruction of their natural habitats. With the expansion of metropolitan areas, highways, recreational areas, and other things which encroach upon wilderness, there is need for more understanding by citizens who will have a voice in making decisions that affect the animal world.

Vocabulary

habitat wilderness species extinction

Activity 1

MAKING LOCAL OBSERVATIONS

Look around such developments as buildings, cultivated fields, orchards, and city parks for different kinds (species) of animals. List as many as possible by common names. Many animals are nocturnal. If night observations cannot be made, sand or mud boards may be placed along trails to record tracks.

Activity 2

FIELD WORK IN RURAL OR SEMI-WILDERNESS AREAS

Visit an area where the land is neither cultivated nor fenced and where people's homes are widely spaced. List by common name as many animals, including birds, you are able to observe. List signs of others which remain well hidden.

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Activity 3

VISIT TO THE WILDERNESS

If possible arrange a wilderness trip. Visit an area which is in a more or less natural state, such as a designated wilderness area in a national forest, or a national park. A nearby game or bird refuge would also be acceptable. Using your binoculars, record all the animals that can be clearly seen and all the information you have been able to dig up. Consult the U. S. Forest Service for a list of primitive and wilderness areas in Oregon, the National Park Service for national parks and national seashores, and the Bureau of Sport Fisheries and Wildlife of the Department of Interior for a list of wildlife refuges in Oregon.

Activity 4

BIRD OBSERVATIONS

An excellent way to become acquainted with and acquire an appreciation of animals in your area is to become a bird watcher. Birds are all around us in city and country. Many are residents the year round. Others come and depart with the seasons.

To be a bird watcher all you need is a good pair of binoculars and a handbook. *Birds of North America,* published by the Golden Press, New York, is one of the best and least expensive. Also quite useful is *A Field Guide to Western Birds* by Roger Tory Peterson, published by Houghton Mifflin Co., Boston, Mass. *Ducks At a Distance,* published by the U.S. Department of the Interior, is invaluable for identifying both ducks and geese.

Students may start their bird watching careers by looking for birds around their homes and in their neighborhoods for a period of a week or longer. They should use some of the books listed, and bring the lists to class. A competition may be created within the class. Students may also be asked to keep scrapbooks of bird photos found in magazines.

Some migratory species such as swallows, hummingbirds, and especially waterfowl may be singled out for special attention, giving students an opportunity to watch for their arrivals and departures, their methods of making nests, their reproductive habits, and the ways in which they care for and feed their young.

Bird watching will arouse the interest of many students and get them involved in conservation activities. Speakers from the local branch of the Audubon Society may be invited to address the class, and to lead field trips where there are congregations of birds.

BIBLIOGRAPHY

Books

Brown, Vinson. *Backyard Wild Birds of the Pacific Northwest.* Jersey City, New Jersey: T.F.H. Publications. 1965.

Collins, Henry H. *Bird Watcher's Guide.* Racine, Wisconsin: Western Publishing Company. 1961.

Hickey, Joseph H. *A Guide to Bird Watching.* New York: Doubleday and Co., Inc.

Appraisal

Students should decide through discussion whether wildlife refuges and wilderness areas are worth preserving. Further research may be necessary to learn more about the history of these refuges and wilderness areas, the economic forces that are fighting the designation of more wilderness areas, and the groups who seek to create more of them.

CURRICULUM RELATIONSHIPS

Social Science

Write essays on justification for traffic in furs and pelts of endangered wild animals and the movement to curb this business in the United States. A typical assignment might be to study the role of Hudson's Bay Company in nearly exterminating the beaver from early Oregon.

Controversial aspects of wilderness and wildlife preservation and the ban on poisoning coyotes recently declared by the Department of the Interior offer opportunities for class discussion and debates.

BIBLIOGRAPHY

Books

Bates, Marston. *Man in Nature.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964.

Darling, Frank Fraser. *Wilderness and Plenty.* New York: Ballantine Books, Inc., 1970.

Hay, John. *In Defense of Nature.* Boston: Little, Brown and Company, 1969.

Netboy, Anthony. *The Atlantic Salmon: An Endangered Species?* Boston: Houghton Mifflin Company, 1968.

Magazines

Many magazines devote space to controversial wildlife and related subjects. Among them are:

Natural History, published by the American Museum of Natural History, Central Park West at 79th Street, New York, N.Y. 10024

National Wildlife, International Wildlife and Ranger Rick (for Junior readers), published by the National Wildlife Federation, 1412 16th Street N.W., Washington, D.C. 20036.

Audubon, published by the National Audubon Society, 950 Third Avenue, New York 10002.

Other Resources

Sierra Club's Exhibit Format Series and Wilderness Conference Volumes, available from the club at Mills Tower, San Francisco, California.

ANIMALS AND MAN

ENVIRONMENTAL NEEDS OF ANIMALS AND HUMANS

Objectives

As a result of this encounter, the student should be able to:

1. Name the basic needs of all animals (food, water, shelter).
2. Describe how man's needs are met in a normal community.
3. Identify three other needs of people (e.g., privacy, "elbow room," love, recreation).

Rationale

Students should develop an understanding that each living thing has requirements which must be met through interaction with its environment.

Vocabulary

habitat predators camouflage experiment

Activity 1

FIELD TRIP: ANIMAL'S NEEDS

Arrange a trip to a zoo, farm, or animal refuge. Guide the children to look for the things that all animals need. Discuss predators, camouflage, and importance of shelter. Observe what is provided by man when animals are not in their native habitat. Narrow the list down to the absolutely essential needs of the animals. Are these the same as needs of forest animals, pond animals, pets?

Activity 2

OBSERVATION: STUDENT'S NEEDS

Discuss the student's own needs. Are they the same as those of the animals seen on the field trip? How are these needs met? Have the students observe and record how their own needs are met at home that evening. On the following day, compare the various observations. Are they all the same?

Activity 3

EXPERIMENT: OVERCROWDING

Crowd all the students and their desks in one-fourth of the classroom. Leave them that way half the day. Tell the students to think about how they feel during this experiment. Record comments, observations, complaints. In the afternoon, move back to regular spacing. Discuss their feelings about being crowded. Ask if they see a relationship between this experiment and living in a crowded city. If they don't volunteer the connection themselves, ask, "Does this illustrate another need of people?"

Activity 4

EXPERIMENT: RECREATIONAL NEEDS

At recess take students to the most undesirable spot available (say, a corner of the parking lot or a bare-dirt area) and tell them that is where they are to play. Record their comments and ask them to compare the area to their usual playground. Have them design an ideal play area. "Does this illustrate another need of people?"

Appraisal

Write and illustrate a booklet on the *Care of a Pet* or *Care of a Child.* Illustrate how different essential needs are met.

CURRICULUM RELATIONSHIPS

Language Arts

Write a story personifying an animal in danger trying to reach its shelter.

Have the student compose a thank you letter to parents for furnishing his basic needs.

Write poems about the "feel" of being too crowded.

Fine and Graphic Arts

Construct a model playground with all the ingredients children feel are necessary.

Social Studies

Enlarge idea of "other needs" of people to include need for such things as clean air, clean water, and quiet. Contact state legislators and communicate this point of view to them.

Ask the principal for an enrollment projection to ascertain whether overcrowding will be a problem in your school. If it will be (or is today), ask him what plans are being made to alleviate this situation.

Mathematics

Figure how much space per child there is in your classroom. Compare this to other schools, if possible.

POPULATION CONTROL-GUPPIES AND MAN

Objectives

As a result of this encounter, the student should be able to:

1. Identify a state of stabilization in a given population of guppies.
2. Identify factors bringing about population stabilization in guppies.
3. Identify factors bringing about population stabilization in humans.
4. Suggest consequences if human population is not controlled.

Rationale

Population stabilization is recognized as a major factor which will determine the adequacy of food supply and living space and which may, ultimately, determine the survival of the human species. This is a long term study which will illustrate a number of factors that influence population control.

Vocabulary

population control overpopulation aquarium stabilization

Materials

2 aquarium tanks of equal size with aeration and food supply to accommodate guppies

51 guppies:
- 19 male
- 17 female
- 16 fry
- 1 pregnant female

Activity 1

SETTING UP EXPERIMENT

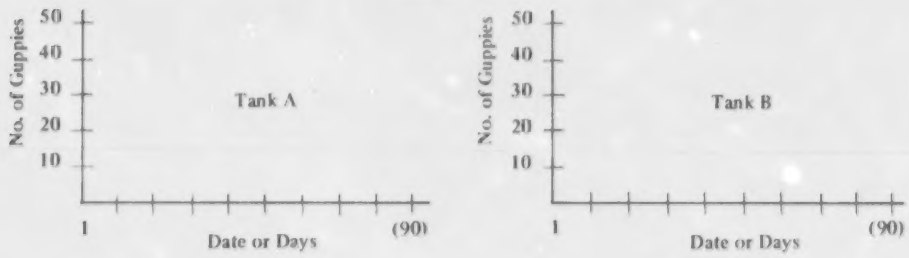
Set up the two identical aquariums. Stock one with 50 guppies: about 17 male, 17 female, and 16 fry. In the second, place the one pregnant female. Feed the fish and take good care of the tanks, being sure the water in each is properly aerated and filtered. Treat both aquariums identically except for the proportion of food.

Activity 2

RECORDING DATA

At regular intervals, say once every day or two, count the number of fish in each tank. If possible, keep track of the number of males and females. Make a graph for each tank and plot the information.

(Sample Charts)



Activity 3

ANALYZING DATA

Run this experiment three to six months. At the end of the period make a careful count of the guppies in each tank. What has happened in the tank that started with 50 guppies? Are there more or less now? If less, what happened to them? Are there any babies now? If not, can you speculate what happened to them? How many males and females are there now?

Look at the chart for the tank with one guppy originally. How many are there now? What is the most that were in this tank at any time? How long did the population remain at this level? Did the population fluctuate? Were there ever any fry, and if so, what happened to them? Did they all live? How many males and females are there now?

Appraisal

It is suggested that a class discussion be held involving the following questions intended to provoke students into thinking about the very grave population problem facing us.

Can we compare the guppy population to human populations? Were any steps taken to control the guppy population or were the laws of nature allowed to prevail?

Do we as humans do anything to control the laws of nature concerning population growth? What would happen (or has happened) if either the birth rate were controlled (decreased) without anything being done about the death rate? What effect does medical technology have on the death rate? What can you find out about infant mortality rates in say the last 50 to 100 years?

Is there something we as humans can do to consciously control our population? Are birth control and legalized abortion possible solutions? What has medical technology accomplished in the area of birth control? Would this be effective if only part of the population practiced it?

CURRICULUM RELATIONSHIPS

Language Arts

Write stories personifying the thoughts of the guppies in the tank of 50, bringing in such ideas as what it feels like to be overcrowded.

Math

See Activity 2.

Social Studies

Study population in some of the underdeveloped and overpopulated countries, such as India and Indonesia.

Study the population of Japan as it rose from an underdeveloped country in the early 19th Century to the present. What has happened to the population in India, Japan, China. What measures are being taken to control it? What are the population projections for the United States?

BIBLIOGRAPHY

Books

Ehrlich, Paul. *The Population Bomb.* New York: Ballentine Books, Inc., 1968.

Hale, Edward. *The Hidden Dimensions.* New York: Doubleday and Co, Inc., 1966.

Lorenz, Konrad. *On Aggression.* New York: Bantam Books, 1970.

World Almanac contains data on population trends, birth and death rates and other statistics pertinent to this exercise.

ANIMAL TRACKS ALONG A STREAM

Objectives

As a result of this encounter, the student should be able to:

1. Identify and describe animal tracks.
2. Make inferences about an animal based on the tracks it leaves.

Rationale

All animals need water in order to survive. Presence of animals is commonly detected near a stream or pond. Search around the edges and look for tracks in the soft sand or mud. These tracks can tell the trained observer a great deal.

Vocabulary

track

Materials

notebook and pencil
mixing bowl
spray plastic or shellac
plaster of Paris and instructions for use
cardboard strips
paper clips or masking tape

Activity 1

OBSERVING TRACKS

Visit an area where animals might come to drink. Have the students search the banks or edges being careful to stay in grassy areas so as not to destroy any tracks.

Students should spread out. When a track is found, record observations about the area and the tracks. Make a sketch of the tracks for possible future identification. Make inferences about the animals that made these tracks.

Activity 2

PLASTER CASTS OF TRACKS

Make plaster casts of as many types of tracks as possible. Be sure that the track is very clear. Follow specific instructions as outlined in this encounter.

Activity 3

IDENTIFYING TRACKS

After returning to the classroom, use the descriptions of the tracks and the casts to identify the animals from reference books. Were the inferences made in the field accurate, close, or in error?

CURRICULUM RELATIONSHIP

Language Arts — Write reports about the animals in the observed area. Include inferences.

Fine and Graphic Arts — Illustrate the reports you have made from the information collected.

Science — Make a study of the habitat of animals you traced to the stream. Read about their food supply, shelter, family size, and predators.

MAKING PLASTER CASTS OF ANIMAL TRACKS

The study of animal tracks is an interesting hobby. To the expert woodsman and naturalist, tracks and other signs left by animals are an open book which tells what has been happening in the lives of these wild creatures.

Here is how to preserve good tracks in mud or clay:

1. Clean track of loose particles of soil, twigs, leaves or other litter.
2. Spray track with shellac or plastic from pressurized can, if available.
3. Form a two-inch wide strip of cardboard or tin into a ring surrounding the track. Press it firmly into the ground to give support, but leave at least one inch to form the edge of the mold.
4. Mix about two cups of plaster of Paris in a tin can or plastic bowl, adding water slowly until it is about as thick as heavy cream. Pour it carefully into the mold until the plaster is about to the top. Allow the plaster to harden at least 15 minutes before lifting it out of the track. If soil is damp, hardening may take longer.
5. When the cast is hardened, lift it out, remove the ring, and clean it by scraping it with a knife blade and washing it.
6. Apply a thin coating of vaseline to the track and the surface of the cast. Place the cast on a flat surface and surround it with a two-inch strip of cardboard or tin, as before.
7. Mix plaster of Paris and pour it into a mold, making certain that the top surface of the casting is smooth and level with the mold. If you plan to use the casting as a wall plaque, place a loop of wire in back of the casting while the casting plaster is still soft. Allow two hours for the plaster to harden.
8. Carefully remove the mold when the plaster is dry. Separate the two layers and wipe excess vaseline from the face of cast and track. Scrape any rough places with a knife blade, or use fine sandpaper. Wash the casting in running water.
9. When the cast is thoroughly dry, paint the inside of the track with India ink or black poster paint. Label it with the name of the track. A coat of clear shellac or clear plastic may be applied to protect and preserve the casting.

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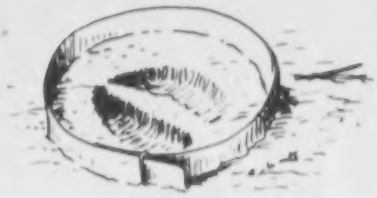
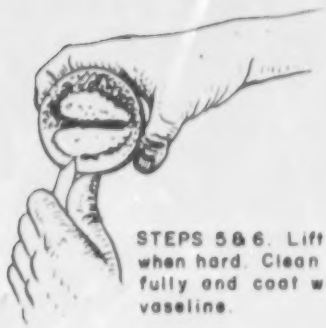
CASTING ANIMAL TRACKS

STEPS 1&2. Clean track and spray with shellac or plastic.



STEP 3. Encircle track with band of cardboard pressed into soil.

STEP 4 Pour plaster of Paris mixture over track.



STEPS 5&6. Lift cast when hard. Clean carefully and coat with vaseline.

STEP 7 Surround casting with wide strip and pour plaster level with mold.

STEP 8 Separate the two layers of casting. Clean vaseline from track and smooth with knife blade.

STEP 9 When caste is dry paint inside of track with black India ink.

ENVIRONMENTAL PROBLEMS

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POPULATION AND THE ENVIRONMENT

Objectives

As a result of this encounter, the student should be able to:

1. Identify the conflicting points of view in the population control controversy.
2. Describe the factors that must be considered to determine proper population-environment relationships.

Rationale

Traditionally, America has looked with favor upon unlimited population growth. However, the environmental crisis has cast this view into doubt. The purpose of this study is to examine the issue of population growth in a rational manner.

Activity 1

EXAMINATION OF TRADITIONAL VALUES

Through class discussion and/or the use of a history teacher as a guest speaker, have the class examine national trends which traditionally have indicated approval of unrestricted population growth. Generate a discussion of whether or not these trends are valid in today's society. Resource people besides historians might include sociologists, psychologists, ministers, and medical doctors. Identify the rationale for differing points of view.

Activity 2

DEMOGRAPHIC STUDY

Have the geography department make a presentation about geography and its effects on population and population concentration. A comparison of nations such as India and Japan could bring out significant points related to the population problems facing the United States.

Activity 3

INTEREST GROUP DEBATE

Invite representatives from groups with differing viewpoints on population control to discuss their views.

Activity 4

SIMULATION PROBLEM ON POPULATION

Divide the class into several groups which represent various viewpoints in regard to population growth, and let the students role play through a discussion of an issue related to the population question. One group may advocate unrestricted population growth, while another may advocate population controls. Other students may role play such persons as geographers, sociologists, psychologists, legislators, and others involved in the population growth issue. Through this exercise, students should come to realize that conflicting views play a crucial part in determining the shape of public policy in such matters.

Appraisal

Have each student through an appropriate form of expression describe his personal views about population control and how he would handle the problem if he had the power to do so.

CURRICULUM RELATIONSHIPS

Geography

See Activity 2.

Language Arts

See Appraisal.

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Books

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Appleman, Phillip. *The Silent Explosion.* Boston: Beacon Press, 1965.

Calder, Richie. *Common Sense About a Starving World.* New York: The MacMillan Company, 1962.

Ehrilich, Paul. *The Population Bomb.* New York: Ballentine Books, Inc., 1968.

Ehrilich, Paul. *Population, Resources, and Environment.* San Francisco: W. H. Freeman and Co., 1970.

Freedman, Ronald. *Population.* Chicago: Aldine Publishing Company, 1964.

Hyde, Margaret. *This Crowded Planet.* New York: McGraw Publishing Company, 1961.

Johnson, Huey D., ed. *No Deposit No Return.* Reading, Massachusetts: Addison-Wesley Publishing Company, 1969.

Malthus, Thomas. *An Essay on Population.* New York: Modern Library, 1960.

Public Documents

U. S. Department of Interior. *Man–An Endangered Species.* Yearbook No. 4. U. S. Government Printing Office, Washington, D. C., 1968. Also *Population Challenge.* Yearbook No. 2. 1966.

Audiovisual Resources

The Division of Continuing Education Film Library, Corvallis, Oregon, has these films:

Brazil: The Gathering Millions
India: Writings in the Sand
Problems of Conservation–Forest and Range
Squeeze
USA Seeds of Change
European Experience
Japan: Answer in the Orient
Problems of Conservation–Water
Troubled Cities
Working Water

GRAPHING WORLD POPULATION AND FOOD

Objectives

As a result of this encounter, the student should be able to:

1. Construct line graphs to illustrate the rate of growth of world population since 1600.
2. Graph the rate at which the food supply is now increasing in the world.
3. Based on the two graphs, predict global food needs.

Rationale

Graphs are efficient ways to present data. The rates of growth for the human population and its food supply differ. This can be clearly seen in graphs of population growth and food production. Most scholars consider the population explosion to be the basic cause of most environmental problems. Population and food production studies are effective ways to focus on this problem.

Vocabulary

exponential curve
vertical axis
kilogram
horizontal axis
arithmetic curve
calorie
extrapolate

Materials

Reference books and articles concerned with both the rate of world population growth and maximum possible rate of increase in food supply.

Note: Both of the Ehrlichs books and the books by Hardin and the Paddocks listed in the bibliography are excellent sources.

Graph paper (10 divisions per linear inch)

Activity 1

GRAPHING 350 YEARS OF HUMAN POPULATION GROWTH

Using figures obtained from reference books and articles, the students (perhaps in small groups) should construct two line graphs. On one, plot the years 1650 to 2000 A.D. along the horizontal axis, and world population on the vertical axis. World population after 1970 may be extrapolated. An exponential curve will be produced.

The second graph will have the same horizontal time scale. On the vertical axis world food production should be plotted in calories, pounds, or kilograms. An arithmetic curve will be produced.

Activity 2

INTERPRETING GRAPHS

Students should use the graphs to calculate changes in the amount of food expected to be produced per person in future years on a world-wide basis.

Appraisal

Students should discuss history and present trends which suggest the average man (on a world-wide basis but not necessarily in all countries) will have a much more meager diet in future years.

Students should submit their graphs (see "Objectives") with explanation of their meanings, listing sources of information, including figures used in graphs.

A logical extension of this activity would be to encourage students to suggest means for avoiding famine in countries where the population growth is outrunning the food supply. Another would be to consider the possible impact of population growth on resources other than food, using the more crowded lands.

CURRICULUM RELATIONSHIPS

Math — Graph and calculate ratios of food units to persons.

Language Arts — Reading, class discussion, and report writing all require use of language skills.

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Borgstrom, G. *The Hungry Planet.* New York: Collier, 1964.

Daedalus. Devoted to population problems. Boston: American Academy of Arts and Sciences, Spring 1968 Issue.

Ehrlich, P.R. *The Population Bomb.* New York: Ballantine Books, Inc., 1968.

Ehrlich, Paul R. and A. H. Ehrlich. *Population, Resources, and Environment.* San Francisco: W. H. Freeman and Co., 1970.

Hardin, G. *Population, Evolution and Birth Control.* San Francisco: W. H. Freeman and Co., 1969.

Paddock, W. & P. *Hungry Nations.* Boston: Little, Brown and Co., 1964.

Paddock, W. & P. *Famine – 1975.* Boston: Little, Brown and Co., 1967.

Encyclopedia (general).

Articles

Critchfield, R. "Feeding the Hungry: Can Politics Keep Up With Technology." *New Republic,* October 25, 1969.

Davis, K. "Population." *Scientific American,* September 1963.

Ehrlich, P. R. "The Coming Famine." *Natural History.* May 1968.

Ehrlich, P. R. and J. P. Holdren. "Population and Panaceas: A Technological Perspective." *Bioscience,* December 1969.

Robinson, H. R. "Dimensions of the World Food Crisis." *Bioscience,* January 1969.

Spengler, J. J. "Population Problem: In Search Of A Solution." *Science,* December 5, 1969.

Williamson, F. S. L. "Population Pollution." *Bioscience,* November 1969.

Pamphlets

Mead, Margaret. *Hunger,* A Scientists' Institute for Public Information Workbook, 1970. Available free from S.I.P.I., 30 E. 68th Street, New York, N.Y. 10021.

AUTOMOBILES

AUTOMOBILES AND MAN

Objective

As the result of this encounter the student should be able to discuss the impact of the automobile on our way of life, including its benefits and drawbacks.

Rationale

The purpose of this exercise is to introduce the student to some conception of the role of the automobile in our daily lives and the problems it creates.

Vocabulary

classification similar order group objects category

Activity 1

VEHICLE ACCIDENTS

Have the class investigate the number and causes of motorized vehicle accidents in the state each year for the past five years, including the number of people killed and injured. Data can be obtained from the Highway Commission or the State Industrial Accident Commission. If possible, obtain information on accidents by vehicle type. What inferences can you make about the safety factor in automobiles based on the information obtained? Does age of vehicle play an important role? What are the requirements for safety in the state vehicle laws?

Activity 2

DRIVING VIOLATIONS

As a follow-up, designate a team of students to visit the city or county courthouse to sit in on driving violation cases. Report findings to class and perhaps have the class discuss the problems encountered in the courts. Discuss the problem of the alcoholic driver and what is being done by the state to handle it.

Activity 3

VEHICLE EMISSION

On the basis of the air pollution section in this handbook, have students investigate the problem of designing vehicles which emit little poisonous waste. What is being done by the government in this field?

Compare Oregon emission control regulations with those in California. Information may be obtained from the Department of Environmental Quality and the Highway Commission.

ENERGY

ENERGY FOR THE PACIFIC NORTHWEST

Objectives

As a result of this encounter, the student should be able to:

1. Identify the sources and potential sources of electric power available in the Pacific Northwest, in Oregon, and in his local area.
2. Describe the factors and interest groups involved in the controversy over future power generation, especially nuclear energy.
3. Identify the points of view of segments of our society which are affected by nuclear power developments.

Rationale

The need for additional energy sources to meet the increasing demands of our technological society is universally recognized. However, we realize that our environment is directly and indirectly affected by power development.

In the Pacific Northwest the bulk of the power we use is hydroelectric power. Until recent years, nuclear power was regarded as too expensive to compete with hydroelectricity or with electricity generated by fossil-fuel plants. However, nuclear power generation is now competitive with other forms of power. Portland General Electric Company is building the Trojan plant on the Columbia River near Rainier, the first nuclear plant in Oregon. Much controversy has developed in Oregon and throughout the United States about the safety and desirability of using atomic fission to produce electricity.

Another element in the power controversy is the argument that Americans use electricity wastefully—in windowless buildings, in electric signs, in air conditioning in climates where it is not really needed. These people say that the by-products of power generation—smoke and particulate emissions from coal-fired or oil-fired plants, and the dangerous radioactive wastes from nuclear plants—are deteriorating our environment and also endangering, in the case of atomic power, human lives.

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This encounter is designed to get students interested in the power issue and make them analyze some of the complex problems involved.

Activity 1

RESOURCE SPEAKERS: PRESENTING THE ISSUES

Invite to the class speakers representing some of the interests involved in the power controversy to participate either in a discussion or a debate. They may include representatives of the private power industry, U.S. Corps of Engineers, conservation groups (e.g., Oregon Environmental Council, Sierra Club), members of the state legislature, Bonneville Power Administration, and others.

Activity 2

GETTING THE FACTS

Students should become acquainted with the power situation in their own community. Have them do research on the sources of electricity used in their community: who generates it, who distributes it, what are the trends in its use and cost? They should be able to give a picture of the generation and distribution of power in the Pacific Northwest and in their own community. Material can be obtained fro... the Bonneville Power Administration, Portland, especially annual reports which show where the power goes. BPA is the distributor for all electricity generated by federal power installations in the Pacific Northwest. This electrical power is sold to private and publicly owned distribution systems and to industry on a wholesale basis only. Retail distribution is done by the local power company, rural electric cooperative, or public utility district.

Activity 3

ELECTRIC POWER USAGE

Ask each student to study and evaluate the use of electricity in his home. Determine the number of appliances, the peak loads during the day, the amount of power used at various seasons of the year on a monthly basis (check the family's electric bills), and the charge per kilowatt-hour.

Additionally, students may check with the local power distributor on projected requirements in the community, and where particular load increases are expected (residence use, farm use, industrial and commercial use). If there is an aluminum mill or pulp mill or other heavy users of power in the vicinity, information should be obtained on the amounts each consumes. Consult the local power company for such information.

Activity 4

A FIELD TRIP

A trip might be scheduled to the headquarters of the Bonneville Power Administration in Portland to see the dispatching center which moves the power from hydroelectric, nuclear, and fossil-fuel plants in the Pacific Northwest to load centers. After the visit, students may be asked to discuss in class their findings and impressions.

Activity 5

ROLE PLAYING

Create a role-playing situation involving students in the Pacific Northwest power controversy. For the simulation, divide the class into as many interest groups as possible. Some of the issues which may be aired are discussed in the rationale above.

Appraisal

Have each student explain what his solution to the controversy would be if he had the authority to make a decision. He should take into consideration both the proposed power needs (as formulated by the Bonneville Power Administration and the power industry) and the points of view of those who would restrict power growth in order to safeguard the environment.

Students should be able to describe the major factors in the power situation and demonstrate ability to make decisions based on information concerning the critical ecological issues.

CURRICULUM RELATIONSHIPS

Science

Students may study the processes and mechanisms by which electricity is generated and distributed over large areas until it reaches the user.

Social Studies

Contrast methods of operation and policies of private power companies and publicly owned distributors such as a rural electric cooperative or public utility district. How are these various bodies regulated?

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Language Arts

Debate and role playing provide experience in critical thinking.

NUCLEAR ENERGY - POWER AND POLLUTION

Objectives

As a result of this encounter, the student should be able to:

1. Describe one or more ways he has detected the presence of radioactivity by using special devices.
2. List three or more potential benefits and three or more possible hazards associated with nuclear electrical plants.
3. Defend a conclusion about the desirability of building a nuclear power plant within 50 miles or less of his own home.

Rationale

There are many federal and state laws governing the construction and operation of nuclear power plants. And many scientists still feel there are dangers associated with the operation of such plants. There is much more to be learned about radiation hazards to humans. Other recognized problems include the disposal of radioactive waste material, handling of radioisotopes, and the release of heat into the water. This encounter is designed to familiarize the student with some properties of radioactive materials and their effects.

Vocabulary

radioactivity
nuclear-powered
isotope
radioisotope
fossil-fuel
cloud chamber
Geiger counter
ionizing radiation
hydroelectric

Materials

Cloud chamber (available at the Oregon Museum of Science and Industry)

Dry ice (available at ice cream shops, packing plants, railroad and trucking companies)

Radioactive isotopes sealed in plastic cubes and packets of Polaroid film (available in kit form Prentice-Hall, Macalaster or as part of the "Introductory Physical Science" (IPS) course now taught in many schools)

Geiger counter (obtain on loan from a nearby college, from your own IMC or IED, from a local industrial firm, or from your science department)

Activity 1

OBSERVING EVIDENCE OF RADIATION

Have students set up cloud chambers according to instructions which may be found in most physical science textbooks. (See, for example, *Introductory Physical Science,* published by Prentice-Hall.) Students should make brief written notes of their observations.

Activity 2

DOCUMENTING RADIATION ON FILM

Pairs or groups of students should expose Polaroid film to radioisotopes according to instructions in the commercial kits available. (Prentice-Hall's text, named above, gives complete instructions for this activity; kits are available from the publisher.)

Activity 3

USING A RADIATION COUNTER

Each student should expose Geiger counters to a radium dial watch or clock; or to a radioisotope cube, and observe the counter's behavior. Radium is not used in clocks and watches today, but old clock faces with radium dials may frequently be found. Suppliers of scientific materials offer relatively safe radiation sources for such an activity.

Activity 4

READING OPPOSING VIEWS OF NUCLEAR POWER

Students should read at least two books or articles, one favoring nuclear plants, and one opposing them. The teacher could contribute by interpreting some of the more technical material concerning pollution problems and biological hazards associated with any form of ionizing radiation. He might also describe briefly the operation of conventional power plants—hydroelectric and fossil-fueled. Students should understand that all methods of producing electrical power cause some undesirable side effects.

The student should list and document both the benefits and hazards he believes nuclear power plants represent. He should be able to take a position for or against construction of a nuclear plant near his home and be prepared to defend his views.

Appraisal

Each student will explain how he has observed radioactivity in the laboratory. He will also list, or name orally, three possible advantages and three disadvantages of nuclear power plants.

The class should be divided into those who favor and those who would oppose construction of a nuclear plant near their homes. An informal debate would be an excellent culminating activity.

CURRICULUM RELATIONSHIPS

Science

Study the effects of radiation on human beings and animals. Investigate the effects of the Hanford Atomic Plant on the salmon runs of the Columbia River.

Social Studies

Read about economic and political issues associated with atomic power generation.

Language Arts

Communications skills will be directly applied in reading, reporting, and discussion of this controversial subject.

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Curtis, R. and E. Hogan. *Perils of the Peaceful Atom.* New York: Ballantine Books, Inc., 1969.

Ehrlich, P. R. and A. H. Ehrlich. *Population, Resource, and Environment.* San Francisco: W. H. Freeman and Co., 1970.

Haber-Schaim, et al. *Introductory Physical Science,* 2nd Ed. New Jersey: Prentice-Hall. 1972.

Novick, Sheldon. *The Careless Atom.* New York: Dell Publishing Co., Inc. (a Delta Book), 1969.

Articles

Clark, J. R. "Thermal Pollution and Aquatic Life," *Scientific American,* March 1969.

Curtis, R. and E. Hogan. "The Myth of the Peaceful Atom," *Natural History,* March 1969.

Fadeley, R. C. "Oregon Malignancy Pattern Physiographically Related to Hanford, Washington, Radioisotope Storage," *Journal of Environmental Health,* May/June 1965.

Woodwell, G. M. "Radioactivity and Fallout: The Model Pollution," *Garden Journal*, July-August 1968.

Public Documents

U.S. Atomic Energy Commission pamphlets, "Atomic Power Safety," and "Nuclear Power Plants" are available at Box 62, Oak Ridge, Tennessee 37830.

Pamphlets

"An Oregon First." Portland General Electric Co., Portland, Oregon.

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PESTICIDES

PESTICIDES AND THE LIVING COMMUNITY

Objectives

As a result of this encounter, the student should be able to:

1. Describe the comparative effects of persistent and nonpersistent insecticides on an insect community.
2. Identify specific examples of the residual effects of pesticides on other living things.

Rationale

Students need to be aware of the varying effects of insecticides on insect populations and their residual effects on other life forms.

Vocabulary

insecticide (pesticide) persistent pesticide nonpersistent pesticide

Materials

3 large plastic bags (small trash can size)
hand lens
note pad, pencil
2 insecticides—one from each of the lists

relatively nonpersistent insecticides:
- Acme Garden Guard
- Ortho Sevin 5 Dust
- Ortho Malathion 50 Insect Spray
- Sears 50 percent Malathion Spray
- Vigoro 50 percent Malathion Spray
- Black Leaf House and Garden Spray

relatively persistent insecticides:
- Sears Rose Dust
- Science Garden Insect Spray
- Ortho Tomato Vegetable Dust
- Spectracide Rose and Flower Spray
- Sears Multi-Purpose Insecticide-Fungicide

Activity 1 **EXPERIMENTING WITH INSECTICIDES** 103

Obtain an insecticide. Study and discuss the precautions for use on the label.

Select three plants with similar insect communities. Observe and record insect interaction and make-up of insect species. Isolate three test plants by enclosing them within inverted plastic bags. Spray or dust the first plant with a persistent insecticide through a hole in the bag and the second with a nonpersistent insecticide. Do not treat the third plant.

When the dust has settled, remove the bags from the three plants. Record the immediate effects. Observe the insect communities on a regular basis for at least one month. Prepare a graph that plots time against total numbers of insects on all three plants. Also compare specific species of insects on the three plants.

Activity 2 **READINGS**

Read books and articles that point up the pesticide residue problems. See Bibliography.

Appraisal

Discuss the pesticide residue problems from all sides. Compare the effect on insect communities of nonpersistent and persistent insecticides and consider the approach to the pesticide problem that is now gaining favor.

CURRICULUM RELATIONSHIPS

Social Studies

Investigate the economic importance of pesticides to agriculture and forestry. Who has the right or responsibility to legislate pesticide control? What are the recent governmental actions on DDT and other persistent chemicals?

Science

Study the relative rates of decay of various pesticides. (Compare the persistent to nonpersistent types.)

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Books

Carson, Rachel. *The Silent Spring.* Boston: Houghton, Mifflin Co., 1962

Commoner, Barry. *The Closing Circle.* New York: Alfred A. Knopf, 1970.

Dorst, Jean. *Before Nature Dies.* Boston: Houghton-Mifflin Co., 1970.

Rienow, Robert and Leona Crain. *Moment in the Sun.* New York: Ballantine Books, Inc., 1969.

SIDE EFFECTS OF PESTICIDES

Objectives

As a result of this encounter, the student should be able to:

1. Identify and describe three or more changes, in addition to insect death, which seem to result from treating a test plot with a commercial insecticide.
2. Identify and describe three or more changes, in addition to weed control, which seem to result from treating a test plot with a commercial weed killer.
3. Formulate inferences based on observations about the side effects of pesticides.

Rationale

It is generally known among scientists that most insect sprays (insecticides) and weed killers (herbicides) can damage or destroy organisms other than their "targets." There are dangers involved in the use of these chemicals and students should develop some awareness of them. (One widely known insecticide, DDT, now banned in several parts of the world, is blamed by many scientists for massive kills of birds and fish.) Because of the great complexity of the following experiments, conclusions should remain tentative. Not all variables can be controlled, but as many as possible should be identified. "Food chains" (series of living things which feed upon each other) generally involve man. So, however complex, these studies are relevant and important.

Vocabulary

pesticide	insecticide
food chain	Berlese funnel
control plot	herbicide
species	propaganda

Activity 1

EXPERIMENTAL APPLICATION OF AN INSECTICIDE

Select, mark off, and label two plots of equal size, A and B. Vegetation and other appearances should be similar. Determine by rough count the number and kind of insects and other animals in both. Scientific names are not necessary in this study. List other forms of animal life which live in or visit the experimental plots. Check the numbers and kinds of animals living below the surface of the soil, using a Berlese funnel. (Instruction for construction and use of a Berlese funnel are given in A Sourcebook for the Physical Sciences by Paul Brandwein). Several shovelfuls of soil should be examined and replaced. Carefully record all observations.

Leave Plot A undisturbed for later use. This will be the control plot.

Study and discuss the dangers in using garden insecticides.

Apply a common garden insecticide to Plot B, the experimental plot. Follow the label instructions carefully.

After the period designated on the label for proper results, repeat application on both plots. Record your observations.

Record on a chart the numbers of each species still left on each plot. Analyze the data in terms of how well the insecticide eliminated the insects, how much the chemical affected other animals, and how the data for Plot B compared with data for Plot A.

Activity 2

EXPERIMENTAL APPLICATION OF AN HERBICIDE

Repeat the five activities described above using a weed killer rather than an insecticide. New plots should be chosen, preferably grass-weed areas.

Activity 3

SEARCHING THE LITERATURE

Each student should read some of the literature on pesticides and herbicides. The class can benefit by reports from many sources.

Appraisal

In a class discussion elicit student interpretations of the data collected. It may be productive to divide a class into several teams, each of which will form conclusions independently about the effects of pesticides. Encourage discussion of the possible effects of pesticides on nontarget species and food chains, extending even to man. Have each student make an oral report based upon his reading. Encourage student alertness to biases, distortions and propaganda found in his reading.

CURRICULUM RELATIONSHIPS

Science

Study chemical control of living things and the importance of food chains.

BIBLIOGRAPHY

Books

Brandwein, Paul F. *A Source Book for the Physical Sciences.* New York: Harcourt, Brace, Jovanovich, Inc.

Carson, Rachel. *The Silent Spring.* Boston: Houghton, Mifflin Co., 1962.

Dahlsten, et al. *Pesticides.* A Scientists' Institute for Public Information Workbook, 1970. Available free from S.I.P.I., 30 East 68th Street, New York, N.Y. 10021.

Graham, Frank. *Since Silent Spring.* Boston: Houghton, Mifflin Co., 1970.

Articles

Committee for Environmental Information. "The Price of Convenience," *Environment,* October, 1970.

Conway, G. R. "A Consequence of Insecticides," *Natural History,* February, 1969.

*Edwards, C. A. "Soil Pollutants and Soil Animals," *Scientific American,* April, 1969.

Frost, J. et al. "DDT on Balance," *Environment,* July-August, 1969.

Harvey, G. R. and J. D. Mann. "Picloram in Vietnam," *Scientist and Citizen,* September, 1968.

*Williams, C. M. "Third Generation Pesticides," *Scientific American,* July, 1967.

*Suggested reading for advanced students only.

LAND-USE PRIORITIES

LAND-USE PRIORITIES

Objective

As a result of this encounter, the student should be able to identify the factors involved in determining land-use priorities in his local area.

Rationale

Historically land-use priorities in the United States have been determined by vested economic interests. Outside New England and former colonial states there has been little planning or control of land use so that too much of our country's natural beauty and long-range usefulness have been destroyed. The purpose of this exercise is to involve students in an investigation of local land-use policies and create an awareness in them that there can and should be better planning for land use.

Activity 1

CURRENT LAND-USE INVENTORY

Through discussion the class should develop a listing of poor land use evident in the community. The list should include such areas as residences, factories, shops, and parks. After the list is made students should try to determine economic, political, geographic or social influences on the development of the area. Was the definition of "good land use" the same 100 years ago as it is today? With today's knowledge and social requirements, would these areas be developed in the same manner?

Activity 2

STATE AND LOCAL GOVERNMENT LAND-USE POLICIES

Obtain and study copies of the new state of Oregon land-use zoning law which requires every county to formulate a land-use plan.

The class or a selected group of students should meet with local planning commissioners to investigate the county's current practices in setting land-use priorities and to see what is being done to comply with the new state law.

Activity 3

FEDERAL GOVERNMENT LAND-USE POLICIES

Obtain a copy of the 1970 Public Land Law Review Commission's report which deals with the lands owned by the federal government. Have the students interview representatives of various interest groups in the community to get their reactions to the proposals of this report. Also, have the students interview local or state officeholders to get their views on the effect some of the proposals in the commission's report would have in our state. Interviews may also be held with officials of the U. S. Forest Service and Bureau of Land Management.

Activity 4

FUTURE VALUES AND PRIORITIES

Through field trips, personal interviews, or contact with guest speakers, the class should determine what the future land-use needs of the county may be. The county planning commission, department of parks and recreation, county board of health and local industrial leaders can project a number of needs. Have the students relate the information to possible land-use policies.

Activity 5

SIMULATING LAND-USE PLANNING

Using an imaginary community, or the local community as a model, formulate the outline of a master land-use plan through a simulation exercise. Divide the students into groups representing all the interests involved. The simulation should result in a map illustrating proposals drawn by the class. Assign monetary and job values to different parcels of land. Part of the class should be young couples who want to rent or build a new house. Is the plan flexible enough to change with new needs?

Appraisal

Ask a local professional planner or county planning commissioner to come to class to evaluate the results of the simulation exercise. If the simulation revolved around the local area, ask the guest to relate to the class, preferably with the aid of maps and model, what is actually planned for the area.

BIBLIOGRAPHY

Books

Dasmann, Raymond E. *A Different Kind of Country*. New York: The MacMillan Company, 1968.

Johnson, Huey D., ed. *No Deposit No Return*. Reading, Massachusetts: Addison Wesley Publishing Company, 1969.

McHarg, Ian. *Design with Nature*. Garden City, New York: Natural History Press, 1969.

Smith, Frank E. *The Politics of Conservation*. New York: Random House, 1966.

Audiovisual Resources

The Division of Continuing Education Film Library, Corvallis, Oregon, has these films:

Cities in Crisis
Cities of the Future
Green City
Uprooted Nation
The Soiled Frontier

LAND-USE ALTERNATIVES

Objectives

As a result of this encounter, the student should be able to:

1. Identify both social values and natural processes involved in making decisions pertaining to land use.
2. Distinguish the merits of alternate plans for land use and support one of his own choosing.

Rationale

Components in an ecosystem are so complexly interrelated that the change of any one of them may have far reaching ramifications for other components and for the entire system. For example, aerial fertilizers are spread to increase tree growth, but the water receiving the run-off may become choked with algae. A dam is constructed to provide power to encourage new industry, but an important salmon resource may be destroyed. A marsh is filled in to build a shopping complex, and the water table may be perilously affected.

Planners must study the possible effects of manipulating any one component of an ecosystem. Only in this way can intelligent and responsible decisions be made about such things as land use. Students can benefit by assuming an analytical role in the study and discussion of land use.

Vocabulary

diversity
bedrock geology
institutional
balance sheet
inundation
inventory

Activity 1

FIELD TRIP—HIGHWAY LOCATION

Select an area being considered as the site of an interstate highway. (Instead of a highway it can be the proposed site of a nuclear plant, a factory or a subdivision.) Arrange a field trip to the area under the guidance of an engineer and/or planning official so that students can learn the social, economic, and ecological considerations involved in selection of the site. Data might be obtained on costs of construction, extent of land acquisition, relocation of families, and other factors.

From the data, the class should draw up a report on what happens when a major construction site is appropriated. The report should list both the positive and negative impact of such an action.

Activity 2

LAND USE SIMULATION

Have the class simulate the selection of a highway route. A teacher and student might explain the simulation as follows and then act as referees.

Objective: The "Planning Commission" is to make a decision regarding the Highway Commission's proposal to construct a highway through a marshy area.

Phase I. The Planning Commission (four people) is elected by the class. The election process should include class nomination of candidates and short speeches by the candidates.

Phase II. Lobbying groups should be set up, for and against the project. Brainstorming sessions should be held with the teacher or student at the blackboard in order to list as many groups as possible in 15 minutes. Be sure to include the Highway Commission as one of the groups. After all possible groups are included, attempt to combine them so that only four or five will participate in the simulation. These groups should be listed on the board, and each student should join the group that interests him most. Make an attempt to balance group sizes within limits.

Phase III. The Planning Commission and lobbying groups should meet individually for 20 minutes in order to get acquainted. Each group should elect a chairman or spokesman and plot strategy.

Phase IV. All groups take their places in the hearing room, which is arranged as it might be in a planning meeting. Call the meeting to order. An opening statement should be delivered by

the Planning Commission. This might be followed by the highway engineer's presentation to the commission. Open the hearing for statements from the floor. A time limit should be set. A decision should then be made by the Planning Commission.

CURRICULUM RELATIONSHIPS

Language Arts

Successful completion of the activities in this encounter will require students to carefully investigate and research information and then organize a case in support of a particular position.

BIBLIOGRAPHY

Books

McHarg, Ian. *Design with Nature.* The Natural History Press: Garden City, New York, 1969.

Audiovisual Resources

Multiply and Subdue the Earth. (Film) Federal Highway Commission, Portland, Oregon.

Reports

Holling, C. S. *Stability in Ecological and Social Systems.* Symposium, Vol. 22, Brookhaven National Laboratory, 1969.

WATERSHED MANAGEMENT

MULTIPLE USE WATERSHED MANAGMENT

Objectives

As a result of this encounter, the student should be able to:

1. Describe the multiple uses of a typical watershed.
2. Identify three problems involved in the proper management of a given watershed.

Rationale

Students are often unaware of the multiple uses of a watershed. They should know that a watershed serves a diversity of needs, including household and commercial consumption, flood control, irrigation, hydroelectric power generation, and recreation. These needs are not always compatible; and, thus, negotiation of water use is often necessary for the common interest. An informed citizenry is more able to influence sound management of water resources.

Vocabulary

watershed pollution multiple use land management

Activity 1

HISTORICAL CASE STUDY

Have students research and discuss the history of the management of a watershed area with which they are familiar. Focus on the roles played by government, the general public, and private commercial interests. Identify instances where good and poor management have been evident. Remember, ecological considerations may not always be compatible with aesthetics. What is poor management? By whose standards?

Activity 2

FIELD TRIP

Arrange a field trip to the area which provides the water supply for your community. Have local authorities explain the management policies for this area.

Activity 3

DISCUSSION OF WATERSHED USERS

If possible, arrange discussion between representatives of public and private organizations and agencies which have an interest in the management of the watershed.

Activity 4

SIMULATION

Create a simulation in which the students play members of groups and organizations both private and public, which use public lands. Have the students discuss or debate problems related to the management of a watershed with which they are familiar.

Have the students discuss the positions the various conflicting interests take in regard to the watershed area. What solutions or alternatives might be proposed by the class?

Appraisal

Have the students discuss the positions the various conflicting interests take in regard to the watershed area. What alternatives may be proposed by the class?

CURRICULUM RELATIONSHIPS

Science

Compare the quality of the water in an area where many trees have been logged off and in an area where the forest is relatively undisturbed.

Language Arts

Have students explain formally how they would manage the watershed.

Creative Arts

Make a film or slide sequence to depict a particular theme related to watershed management.

Mathematics

Determine the number of acres in the watershed from maps or aerial photographs.

BIBLIOGRAPHY

Books

Bates, Marston. *The Forest and the Sea.* New York: New American Library, 1960.

Dasmann, Raymond. *The Destruction of California.* New York: Collier Books, 1966.

Frank, Bernard and Anthony Netboy. *Water, Land and People.* New York: Alfred A. Knopf, 1950.

PROTECTING NATURAL WATERS-A STUDY OF VALUES

Objectives

As a result of this encounter, the student should be able to:

1. Name one or more ways in which water quality in a river, creek, lake, estuary or ocean is being altered, and offer evidence based on personal observation.
2. List one or more sacrifices which would be required of people in our society if water quality is to be improved.
3. Explain why the sacrifices might be justified.

Rationale

No well-organized, sustained effort adequate to provide the environmental protection we require, can be expected unless most people agree upon some basic reasons for the actions required. Environmental pollution in an ever more crowded world may force us to review some of our long-held values. Is the pollution-to-population ratio always valid?

Vocabulary

environment pollution pollutant pesticide

Activity 1

FIELD OBSERVATIONS

Students should visit a nearby body of water and carefully examine the animal and plant populations in and around it. They should make notes of their observations. What is the color and temperature, how clear or turbid does it appear, what floats on its surface.

Activity 2

TRACING POLLUTION TO ITS SOURCE

In preparation for this activity the student should read some of the literature on water pollutants and their effects. Also, resource persons concerned with water quality might be consulted. See the references at the end of this encounter.

Potential or obvious sources of contamination the student may recognize should be traced to their sources (e.g., pesticides and fertilizers applied to surrounding agricultural areas, sewage outfalls, thermal and/or chemical discharges from industrial plants). Of course, it may be impossible to discover points of origin. The search will be quite meaningful regardless of how successful the student is in finding the precise origin of the contamination.

Activity 3

INTERVIEWING FARMERS, INDUSTRIALISTS AND PUBLIC OFFICIALS

Those individuals (farmers, public officials, sanitary authorities, and industrial managers) who control the introduction of pollutants may be interviewed. The interview should be designed to bring out the possible costs of certain actions; e.g., how much income does the farmer realize by using chemical sprays rather than relying on natural processes to take care of insect infestations; or what would a good sewage treatment facility cost? The student's notions of costs will reflect the opinions of persons he interviews. Precise dollar figures are not the goal here. What the student will learn is how people involved feel about the economic aspects of their activities, what they believe costs to be, and how they perceive the political and economic issues related to their activities. Students should keep good notes on each interview.

The individuals interviewed should be questioned about their willingness, or unwillingness, to make some sacrifices in the interest of pollution abatement. They also should be asked what they believe should be done to control pollution and who should do it. What steps have they taken in the past ten years to control pollution? How much pollution would take place without man?

Appraisal

The student should report changes that occur in natural water areas due to contamination or pollution. He should be able to identify the point of view which permits this practice in the community and he should be able to challenge or defend these points of view in a class discussion.

CURRICULUM RELATIONSHIPS

Science

Study the chemistry and biology of water pollution.

Social Science

Examine the economic determinants of pollution.

BIBLIOGRAPHY

Pamphlets

Berg, George G. *Water Pollution.* A Scientists' Institute for Public Information Workbook 1970. Available free from S.I.P.I., 30 East 68th Street, New York, N. Y. 10021.

Millipore Experiments in Microbiology. Millipore Corp., Bedford, Mass. 01730. Free manual describes in detail methods for detecting pollution in water, air, and soil.

PARKS

PARKS FOR THE PEOPLE

Objectives

As a result of this encounter, the student should be able to:

1. Describe the use pattern of a typical city or county park.
2. Study the objectives of the parks and recreation department for a particular park and determine how well they are being met.

Rationale

Parks serve the recreational needs of a community in a variety of ways. Students should realize how parks meet or fall short of meeting these needs. Thus, as much as possible, students should gain an understanding of park design and utility.

Vocabulary

social value recreation

Materials

clip board mapping materials

Activity 1

FIELD STUDY IN A PUBLIC PARK

Take the class on a visit to a public park. Ask students to work in small teams, each attempting to learn as many uses of the park by man and animals as possible. Observations should be noted in a journal or log book. It may be convenient to look at the people who use the park and study their habits. Also observe automobile traffic and areas of considerable wear in the park.

Students may assume the role of an "assessment team" to determine how the park is being used. This might involve looking at the park at different times of day to note different activities.

Activity 2

PARK DEPARTMENT OBJECTIVES

Arrange to have a member of the park department staff speak to the class. Ask him to focus on the objectives of community parks and how he feels they are being met. Then have the students as members of the park observation teams separately discuss their finding in relation to the speaker's presentation. Regroup for a general discussion and dialogue with the speaker.

Activity 3

PARK CHANGES

Ask students to write objectives for management of the park they visited. Include recommendations for changes that would provide more recreational opportunities for the community. Remember other nearby facilities such as school groups may provide recreational opportunities. These should be noted. Also note other related phenomena. Is it adjacent to a busy street with no crossing access for children? Would a crossing signal change the usage? Does poor lighting discourage people at night?

Activity 4

PARK BOARD MEETING

Find out when the park and recreation board plans to meet next. Request time on the agenda. Elect a student representative to present a plan for park changes. All students should plan to attend to support their spokesmen.

Activity 5

PROPOSED PARK STUDY

Learn what plans the park and recreation department has for new parks. Select a proposed park in the nearby locale and study objectives and plans for its construction. Include cost considerations. Property in downtown Portland is worth about $1 million a block. Annual property taxes are about $30,000, which will have to be made up by increased tax rates on other property.

Activity 6

WILDERNESS PARK

Arrange a field trip to Forest Park in Portland, or wilderness area in the state. Go through the same procedure in this area as followed in Activities 1-4.

Appraisal

Request one or two landscape architects who plan parks to appraise the park plans developed by the students.

CURRICULUM RELATIONSHIPS

Language Arts

Students can develop interview and observation skills in studying park use and management. They can develop speaking or writing skills in presenting plans for park change.

Fine and Graphic Arts Students may make sketches, films, illustrations, and/or slides to support their recommendations to the park and recreation board.

BIBLIOGRAPHY

Books

Jacobs, Jane. *The Life and Death of Great American Cities.* New York: Vintage Books, 1961.

PRIVATE ENTERPRISE AND THE ENVIRONMENT

ENTERPRISE IN THE ENVIRONMENT

Objective

As a result of this encounter, the student should be able to discuss some of the complexities involved in the relationship between private enterprise and the environment, and the difficulties private enterprise has operating in a technological society which impinges upon the environment.

Rationale

Because industrial endeavors in a technological society use raw materials, alter natural environmental processes, and often create unnatural by-products (such as industrial wastes), these commerical activities (and their sensitivity to their impact on the environment) deserve close scrutiny.

Vocabulary

diversification
ecology
standard cost
monitoring
economics
hybridization
profit accountability

Materials

log book pencil tape recorder

Activity 1

FIELD TRIP TO A FARM

Make arrangements for students to visit a nearby farm. Consult the county agent or soil conservation service for the name of a farmer who has a diversity of crops and an understanding of good land practices in his operation. Suggest that students work in pairs or groups, noting observations and questions in their log books. Let them observe the entire operation. Hopefully, the farmer will spend some time on the tour with the group but also allow the students to wander freely, letting their curiosity guide them. Suggest that students question the farmer about the cost of operation and the profitability of farming. Remember that most farm products are commodities. (The farmer has no control over the wholesale price.) Also some prices are regulated by government.

Activity 2

FIELD TRIP TO AN INDUSTRIAL PLANT

Arrange a tour to an industrial plant which produces only one or two products. Make an appointment with the plant manager so that students can ask questions about what they have seen. Suggest that students ask questions about the ecological implications of production practices noted on the tour. Do not confuse personal aesthetics with pollution or hazardous discharges. What changes have taken place in the operation in the last 10 years?

Activity 3

ANALYZING THE INFORMATION

Using the log books as a resource, ask the students to write on the blackboard pertinent data collected on the visits to the farm and industrial plant. Discuss and contrast the perceptions of the two owners. Based on your investigation, how does private enterprise conflict with the environment? What can be done to mitigate or eliminate this conflict? Consider the profit motive in addressing these questions.

Appraisal

Ask students to tell or write about some of the environmental and economic factors involved in the operation of a pulp mill, an aluminum smelter, a seed farm. What changes have taken place in the last 10 years? Are Oregon industrial plants making valid efforts to correct problems?

CURRICULUM RELATIONSHIPS

Language Arts

Activities in this exercise provide the opportunity for students to learn how to interview and to formally report observations. Preparation for interviewing should precede Activity 1.

Creative Arts

Some students may wish to sketch or film contrasting environments.

Mathematics

Students may be interested in comparing fertilizer utilization to production rates. The student might want to investigate industrial plant profit accountability, budgeting practices, and quality control measurements.

BIBLIOGRAPHY

Books

McHarg, Ian. *Design with Nature.* Garden City, New York: The Natural History Press. 1969.

Ward, Barbara. *Space Ship Earth.* New York: Columbia University Press, 1966.

Articles

Galbraith, J. K. "Economics and Quality of Life." *Science* 145:117-123, 1964.

Audiovisual Resources

Multiply and Subdue the Earth. (Film.) Federal Highway Commission, Portland, Oregon.

The Redwoods. (Film.) Associated Films, Hayward, California.

Matter of Time. (Film.) National Parks Service, Regional Office, Seattle, Washington.

ADVERTISING AND THE ENVIRONMENT

Objective

As a result of this encounter, the student should be able to identify how the advertising media use the environmental issue to promote products.

Rationale

Each day we are exposed to many forms of advertising. In recent years many ads have been taking advantage of ecological themes to sell products and services. Themes related to pollution control are especially prevalent and often prove profitable. Students need to become aware of advertising psychology and methods in order to appraise advertising related to environmental themes.

Vocabulary

media commodity regulatory agencies

Materials

magazines log book

Activity 1

FIELD TRIP—ADVERTISING MEDIA

This activity is designed to bring the student into direct contact with the methods used by business and industry to promote products. Visit an advertising agency, T.V. or radio station. Read major city newspapers and magazines to examine advertising content. Observe billboards and other forms of outdoor advertising in the community. Study television and radio to evaluate certain commercials.

Activity 2

INDUSTRIAL PUBLIC RELATIONS STUDY

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Identify some industries whose public relations programs the class may study. Possibilities are industries dealing with petroleum, forest products, electrical appliances, chemicals, real estate, automobiles, and beverages. Also include public utilities and such agencies as port authorities. Students should select industries which interest them and then form small groups to investigate the advertising and public relations programs of those organizations.

Students should collect or record examples of advertisements. They may also contact the industries involved or their local or national association representatives, and look into local, state or national regulatory agencies dealing with the industry.

What are the approaches used by the various media to advertise for the industry? Who are the people they are trying to reach? What means do they use? Are there ethical and environmental considerations? What are the social implications of the various approaches? Is it informative? Is it helpful? (Remember there are government agencies which control content.) Does it support public environmental efforts? Does it encourage others to work for better environment?

Activity 3

PUBLIC RELATIONS METHODS

This activity will bring students into contact with public relations methods. Invite a public relations firm in your community to provide a speaker, or if none is available, ask a spokesman from the nearest large company to talk about "Pollution Control, Technology, and Industry."

Request the speaker to describe an environmental problem faced by his agency. Divide the class into small "buzz" groups to come up with a solution to the problem. Regroup and allow the speaker to respond to alternatives presented by the small groups.

Activity 4

REGULATORY AGENCIES GOVERNING ADVERTISING

If possible, arrangements should be made for students to meet with representatives of agencies such as the Food and Drug Administration, Federal Trade Commission, and Federal Communications Commission that regulate advertising. They should also meet with public officials who have an interest in advertising. It may be worthwhile to contact the business manager of a local newspaper, radio station, or television station and interview him on his company's policies in accepting advertising.

Appraisal

Each "business group" (independent study) can be written up as a case study to show what methods of advertising are used stressing an environmental theme.

CURRICULUM RELATIONSHIPS

Social Studies

Trace the historical development of the timber industry's use of advertising in relationship to its involvement in environmental quality control.

BIBLIOGRAPHY

Books

Johnson, Huey D., ed. *No Deposit, No Return.* Reading, Massachusetts: Wesley Publishing Company, 1970.

Marine, Gene. *America the Raped.* New York: Simon and Schuster, 1969.

Packard, Vance. *Hidden Persuaders.* New York: David McKay, Inc., 1957.

ENVIRONMENTAL BLIGHT

Objectives

As a result of this encounter, the student should be able to:

1. Identify and document, by photographs or sketches, six or more places within the community which he considers attractive. He also will be able to identify and document six or more places he considers unattractive.
2. Outline the reasons he considers a given location attractive or unattractive.

Rationale

Aesthetic considerations cannot be omitted from a program of environmental education. The attitudes students develop will have much to do with the look of tomorrow's world. This encounter is meant to encourage students to look critically at the world about them. Differing viewpoints should be welcomed.

Vocabulary

environmental blight aesthetic

Materials

camera, or sketch pad pencil notebook

Activity 1

DOCUMENTING STUDY LOCATIONS

The student should critically examine his community by walking around as much of it as possible. He should photograph or sketch at least six of the places he finds most aesthetically appealing and six places he finds most unattractive. He should record in a notebook the reasons for his choices. What would be required to make the unattractive area look better? Are the lighted areas privately or publicly owned?

Activity 2

CLASS WORK

All students should present their pictures to the class, together with the reasons for their choices. Differences should be expected in student opinion, and free discussion of viewpoints should be encouraged. The pictures could later be used to illustrate a written report of the encounter.

Appraisal

Ask students to list changes they would make in designing an ideal community in terms of eye appeal. Ask them also to consider the problems their proposed changes would create and to suggest solutions to such problems.

Conduct a panel and assign students to support a different point of view than their own.

CURRICULUM RELATIONSHIPS

Fine and Graphic Arts

See Activity 1.

English

Development of communication skills is essential to this encounter.

BIBLIOGRAPHY

Books

Blake, Peter. *God's Own Junkyard.* New York: Holt, Rinehart and Winston, Inc., 1960.

McHarg, Ian. *Design with Nature.* New York: Doubleday, 1971.

Vaughan, Thomas and George A. McMath. *A Century of Portland Architecture.* Portland, Oregon: Oregon Historical Society, 1967.

Whyte, William H. *The Last Landscape.* Manhattan Beach, California: Anchor Books, 1970.

INDUSTRY'S ROLE IN ENVIRONMENTAL QUALITY CONTROL IN OREGON

Objectives

As a result of this encounter, the student should be able to:

1. Identify general responsibilities industry has in relation to resource use and environmental quality.
2. Determine what responsibilities the general public has in establishing and maintaining balanced policies of economic development and environmental protection.
3. Identify the extent to which local industries are meeting their obligations for environmental protection while pursuing economic growth.

Rationale

Historically American industries have exploited resources for private gain with little or no thought to the future. With the current emphasis on environmental protection, concern over industry's responsibility to the environment and to society is widespread and justified. Can we generalize to include all industry? How long has technology been available so industry could live up to its environmental responsibilities?

Activity 1

IDENTIFYING ENVIRONMENTAL PROBLEMS

As a suitable introductory activity, a film or videotape such as NBC's "Who Killed Lake Erie?" or "The Soiled Frontier" might be shown to the class. This would serve not only to introduce the subject but point out what can occur if there is no plan of control for the development of an area.

Relate this presentation to a problem involving a local industry, such as a lumber mill, a paper mill, or an aluminum smelter. What type of wastes do these plants discharge? Is it harmful after treatment? Are there any public health problems associated with these types of wastes? Also consider field burning and other open burning detrimental to air quality.

Activity 2

A CASE STUDY

Do a case study in depth of a local industry and its relationship to the environment. Choose one which indicates a willingness to work with your class. Have the class determine the positive and negative environmental effects of the industry and also its importance to the community. Possible information sources include newspaper editorials, local conservation groups, governmental agencies, or industry, trade or technical associations knowledgeable about the industry.

For example, if it is a lumber or paper mill, consult the U.S. Forest Service, the local office of the Department of Environmental Quality, Associated Oregon Industries, Northwest Pulp and Paper Association (Seattle, Washington) and the National Council on Stream and Air Improvement.

After all sides are investigated, determine which story is the truest picture of the real facts. The study should be followed by a report, a discussion of the findings, and recommendations.

Appraisal

Through some form of expression have each student explain his feelings and recommendations on the case study. The report should take into consideration different points of view as well as economic, political and social implications.

CURRICULUM RELATIONSHIPS

Language Arts

See Appraisal.

BIBLIOGRAPHY

Books

Commoner, Barry. *The Closing Circle.* New York: Knopf, 1971.

Johnson, Huey D., ed. *No Deposit No Return.* Reading, Massachusetts: Addison-Wesley Publishing Company, 1969.

Josephson, Matthew. *The Robber Barons.* New York: Harcourt Brace, 1934.

Marine, Gene. *America the Raped.* New York: Simon and Schuster, 1969.

Myers, Gustavus. *History of the Great American Fortunes.* New York: Modern Library, 1964.

Smith, Frank E. *The Politics of Conservation.* New York: Random House, 1966.

Udall, Stuart L. *The Quiet Crisis.* New York: Holt, Rinehart, and Winston, Inc., 1963.

Audiovisual Resources

These films are available from the Division of Continuing Education, Corvallis, Oregon:

New Forest *Pass Creek* *Who Killed Lake Erie?*

STUDENT NEEDS AND PERCEPTIONS

SENSORY AWARENESS

Objective

As a result of this encounter, the student should be able to describe perceptions about his environment based on observations received through one or more of the five senses.

Rationale

A heightened sense of perception can enhance some of the most commonplace experiences in our daily lives, such as a child's smile, the warmth of sunlight, a taste of candy, or smell of lumber. A student needs to become aware of all his senses and the messages they are continually receiving.

Vocabulary

perception

Materials

handkerchief (large) 2 types of soil Douglas fir cone

Activity 1

EXPERIENCING RAIN

In the Northwest we have considerable rain and wind. While most of the time the weather is mild, sometimes storms approach ferocious proportions as on Columbus Day 1962. Since children are out in the rain much of the time, ask the students how they see and feel rain. What is the sound of rain?

Ask them to recall a time when they were "drenched to the bone," enjoyed a hike, watched a parade or sports event in the rain. How did they feel? Who were they with? Ask them to describe their mood on a rainy day.

Play the record "Raindrops Keep Falling."

Show the filmstrip "Wind and Rain" and discuss it. Focus attention on sounds and moods in the presentation.

Read or play a tape of poems whose theme is rain. Show the film, "Olympic Rain Forest."

Activity 2

USING THE SENSES

Arrange a trip to a park or arboretum. Ask students what senses they use to perceive plants. Ask them to try to use only one or two senses. Move to a tree and discuss what one can learn about a tree from merely looking at it. Focusing on one sense at a time, discuss how one can learn more about trees by looking, listening, touching, feeling, or tasting.

Blindfold students and ask them to make observations about a given plant. Discuss how blind people often develop extra-sensitive hearing.

Listen for bird calls in the woods. What form of identification do most people use?

Activity 3

EXPERIMENTS IN SENSORY AWARENESS

Blindfold two students in an informal group setting, then have them move about the room, talking. Discuss how it would be easier to move about if the students had a heightened sense of hearing, so they would know where people are. Would humming help to orient them? Ask the two "blind" people to discuss their experience.

Take precautions to prevent injuries by removing dangerous objects from the area.

Select two students. Blindfold one and have him take a sample of soil and pass it on to the student without a blindfold. Ask each to describe the soil. Compare the descriptions.

Ask each student to draw conclusions about the soil and surrounding animal life.

Observe a Douglas fir cone. Ask the students to describe how it would feel without touching it. Let them feel the cone and describe it.

Appraisal

Have the students explain why human sensory potential is often unused.

CURRICULUM RELATIONSHIPS

Language Arts

Have the students write poetry capitalizing on sensory perceptions.

Fine and Graphic Arts

Have the students record the effects of wind and rain in close-up sketches and photographs.

BIBLIOGRAPHY

Audiovisual Resources

Carnivorous Plants. (Film) Moody Institute of Science, Los Angeles, California

Olympic Rain Forest. (Film) Sierra Club.

Wind and Rain. (Filmstrip) DCE Film Library, Gill Coliseum 133, Corvallis, Oregon.

THE SCHOOL AS AN ECOSYSTEM

Objective

As a result of this encounter, the student should be able to describe components of the school environment in terms of an ecosystem.

Rationale

Students seldom think of it, but the school environment itself constitutes an ecosystem. By looking at the school and its components as an interrelated life system, students may begin to become conscious that all environments containing living organisms constitute ecosystems.

Materials

thermostats notebook handkerchief

Vocabulary

ecosystem

Activity 1

SCHOOL HEATING SYSTEM

The school heating plant represents an example of a system component which students should readily comprehend. Arrange for the engineer to conduct a tour of the heating plant and heating network. Include an examination of the control devices.

Return to the classroom. Discuss how the heating plant relates to the entire physical system.

Activity 2

CAFETERIA

It may surprise students to learn the amount of food consumed and waste disposed of in one day in their school cafeteria.

Request the cafeteria manager to conduct a tour of the cafeteria for students. Ask him to describe what items go in, what comes out, and how the flow is controlled. Following the tour, discuss the cafeteria as an ecosystem with the head of the cafeteria present. Waste disposal, recycling of resources and dietary details ought to be covered.

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Activity 3

SCHOOL ARCHITECTURE AND GROUNDS

Invite to class an art teacher or preferably the architect or representatives of the firm that designed the school. Tour the building to discuss the design and function of the school. Discuss in class the school as an ecosystem.

Appraisal

Students sketch or write descriptions of the school cafeteria and heating system as an ecosystem. Ask them to make a similar study of systems at home.

CURRICULUM RELATIONSHIPS

Science

Make a study of the Apollo space craft life support system as an ecosystem. Write to NASA for details.

Language Arts

Students may write articles for the school newspaper in a campaign to reduce use of one-way containers and waste.

BIBLIOGRAPHY

Book

Commoner, Barry. *The Closing Circle.* New York: Knopf, 1971.

Article

Snyder, Gary and Alan Watts. "The Wilderness and Non-Verbal," *Center Magazine,* July/August, 1970.

SOLID WASTE

SOLID WASTE

Objectives

As a result of this encounter, the student will be able to:

1. Identify and list materials which go into garbage dumps and landfills and that might eventually pollute the air and water.
2. Identify waste materials in household and school which are recyclable, reusable, biodegradable.
3. Know how to prepare household and school wastes for recycling and know where to take them for proper recycling.
4. Select products for purchase with knowledge of their environmental impact as solid waste.

Rationale

The United States is the world's largest consumer of goods today. Each person in this country discards almost six pounds of trash and garbage per day. Solid waste is a pollutant we can individually control—by careful consumption and by recycling. Students should be aware that there will always be some materials which cannot be recycled. These materials should be disposed of in an environmentally and socially acceptable manner.

Vocabulary

solid waste recycling reuse sanitary landfill leachate biodegradable composting aerobic - anaerobic depot secondary materials modified landfill compacted

Note: In an activity which involves handling waste materials, careful personal hygiene practice should be observed.

Activity 1

VISITING DISPOSAL SITES

Arrange visit with county sanitarian. The student should go to a nearby municipal garbage disposal site armed with note pad and pencil. Is it an open burning dump? How often do they burn? What happens to the burned residue? What materials cannot be burned and what is done with the noncombustibles? Which direction does the wind usually blow smoke from the site? Does it serve as an irritant to nearby households, if any? Slight? Severe?

A sanitary landfill is a disposal site which is covered with about six inches of compacted dirt each day. A modified landfill is covered less frequently. What special operating equipment is necessary? Is the site close to a river or stream? Does leachate flow from the site? Can it be tracked to determine where it originates and discharges?

What materials are being discarded which could be reused or recycled? Note what types of materials seem to be the larger part of the discard. Are there any separating or salvaging activities going on? How much material goes into this site each week? How long will this site last?

Activity 2

GOING ON A COLLECTION ROUTE

The student should follow a residential collection route or talk to a sanitary truck driver (garbage collector). Which types of dwellings generate the most waste per unit? How far is the disposal site from the collector's route and what types of collection equipment are used? How often does the collector follow the same route? Does the amount of garbage collected each time vary? Note the procedure at disposal site. Are the trucks washed, and where does the washwater go?

Activity 3

COMPOSTING

Materials

school solid waste samples	one gallon heavy glass wide mouth jar with lid
meat grinder	thermometer

Collect a sampling of the school's solid waste—include paper, sandwich wrappings and bags, lunch scraps, grass clippings, bedding from animal cages, and plastics.

Shred solid wastes with an old meat grinder and place in jar; add a handful of soil from an area where there is vegetation growing and mix thoroughly with wastes; sprinkle with enough water to make moist, but not soggy, and put on jar lid.

Each day open jar and stir contents to provide oxygen for the aerobic organisms. Students can keep a periodic record of: (1) temperature of decaying mixture; (2) progress of decay of the various materials.

Decay of biodegradables should take no more than one month.

Activity 4

SCHOOL SOLID WASTE

The school, like any other institution, generates a whole variety of solid wastes. Ask the janitor:

1. What is the amount of garbage collected at school every week?
2. Does the amount and composition vary from time to time?
3. Where does the school's waste go for disposal? Is there any recycling? By whom?
4. What parts of school do the wastes come from?

Next, you will want to find out which school wastes are recyclable. Are there any recycling centers in the community? Are there waste paper companies which will buy school waste paper, such as old notebook paper, or office paper? How must the materials be sorted and prepared by recycling to be acceptable to the collector?

Where in the school should various wastes be collected? What type of collection containers for recyclables should be set up in each area? Can students assist in monitoring the collection and proper preparation of recyclables in each recycling area?

Suggest a means of transportation of recyclables to a recycling industry or depot. School waste paper, if correctly sorted, is often valuable enough for a recycling company to pick up.

Imagine other techniques for decreasing school solid waste. Suggest ideas like using both sides of each piece of paper.

Initiate a program to record progress in your school's solid waste recycling campaign. Show how much waste is being recycled. How much remains to be disposed of? What types of materials predominate in this residue?

Record how the janitor, school administration, cafeteria workers, teachers and students of various ages feel about the program. What further improvements can be made?

Activity 5

SOLID WASTE AND CONSUMPTION

Take a trip to the local grocery store. Focus on several types of consumer items. You will want to investigate packaging methods and determine what solid waste factors are important to consider when making a choice of containers.

Record the brand; type of packaging (cardboard, plastic bottle, waxed paper envelope, etc. and indicate when there is a combination of more than one material in a package); whether the one or more materials in a container are recyclable, biodegradable, reusable and/or returnable.

Can you account for the function(s) of the packaging you see? What are your ideas for reusable, returnable containers for each item you have investigated?

Observe the checkstand packaging procedures. Are meats and frozen foods bagged in plastic? Do any customers supply their own shopping bags or reuse paper and plastic bags?

Imagine methods for retrieving recyclable and reusable containers at a grocery store. Explore the idea of standard containers for a variety of products, as well as the idea of personal containers to be brought to the store for refilling.

Ask what arrangements the store has for recycling and reuse of various materials (shipping containers, beverage containers, etc.). Suggest changes on the grocery store level which can encourage recycling and reuse.

Write letters to manufacturers of products which are overpackaged or packaged in nonrecyclable, nonbiodegradable containers. Be careful in determining what constitutes overpackaging; it may be, for example, designed to minimize spoilage.

Activity 6

RECYCLING CENTERS

Visit a community recycling center which accepts household solid wastes and talk with the people working there. Find out how much recyclable waste is being collected. What is the value of this waste?

What are the handling procedures? How does the center market its recyclables? Is the public cooperative? What are the center's greatest problems? How might they be solved? How can the public's use of the center be encouraged?

If possible, arrange to go with the organizers when they make their periodic trip to sell their recyclables to a market. This may be a glass container plant, a paper buyer's warehouse, a scrap metal dealer—depending on what the recycling project collects.

Identify what materials are not presently being recycled in your community. Find out why.

Are recycling activities in your community adequate? If not, look into the possibility of starting another recycling project. Is there a school class or club which needs to earn money? What would be the benefits to the community?

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There's No Such Things as GARBAGE, Oregon Recycling Information and Organizing Network (ORION), 2637 SW Water, Portland, Oregon 97201.

For More Information

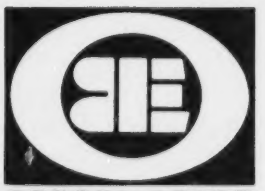
Portland Recycling Team, 1207 SW Montgomery, Portland, Oregon 97201, 228-6760; speakers and field trips.

Recycling Switchboard, 222-3952; for information on recycling projects and markets.

Department of Environmental Quality, 1234 SW Morrison, Portland, Oregon 97205, 229-5696.

For Technical Information on Solid Waste/Recycling

Available Information Material: Solid Waste Management, (bibliography), U.S. Environmental Protection Agency, periodical.



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